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OCTOBER, 1848.

CIVIL ENGINEERING.

Description of a Portable Cofferdam, adapted specially for the use of Harbor and other Marine Works in exposed situations. By THOMAS STEVENSON, F. R. S. E., F. R. S. S. A., Civ. Eng., *Edinburgh. Read before the Royal Scottish Society of Arts, 10th of January*, 1848.

When it is necessary, in the execution of marine works, to carry on founding or excavation in exposed situations within the high water-mark, cofferdams of the common description are not found to be answerable. Many circumstances conspire in rendering such erections inapplicable in situations where they are required to stand for several tides. The waves occasioned by a very moderate breeze of wind will, in many cases, even in the course of a few hours, either entirely break up a well-constructed cofferdam, or render it leaky and unserviceable. Again, where there happens to be a covering of a few feet of sand above a rocky bottom, the piles will be found, even where there is shelter from the waves, to have no stability, and to fall inwards as the sand is removed from the interior, although every care be taken to support them with *shores* or struts.

The temporary dams which are generally employed in the execution of tide-works are of a very simple construction, and are intended to be serviceable during only one or two tides. They consist of a row of short piles which are driven in the line of a runner or waling-piece, and as the excavation proceeds, the piles are from time to time driven further down. But this kind of erection is very unsatisfactory, and in

many situations, and for a variety of purposes, it is in fact quite useless; for I have always found that it was impossible, with this dam, to drive the piles straight, from there being only one waling-piece to direct them. But even although they could be driven, a farther source of inconvenience still remains, for, as the stuff is removed from the interior, there is nothing left but the single waling to resist the pressure from the outside, and the bottoms of the piles being speedily forced inwards, all attempts to carry the excavation farther must necessarily be abandoned.

At Hynish harbor, Argyllshire, in 1843, I had a talus-wall to found on sand, which covered a rocky beach to the depth of from two to three feet. At another place, the rock was not only to be bared, but a navigable channel, twenty feet wide, and in some places as deep as eight feet in the rock, together with a small tide-bason, were to be excavated to the level of the low-water springs. The shores also were frequently subject, even during the summer months, to a very heavy surf.

The excavation of the tide-bason, which formed the landward part of the work, was effected by means of a series of dams, consisting of walls, built of Pozzolano rubble. These were found to be quite water-tight, and to answer remarkably well in every respect; but they required, for their protection against the waves, a considerable bulwark or breakwater of *Pierres perdues* to shelter them from the waves.

In the excavation, however, which had to be undertaken seaward of the breakwater of *Pierres perdues*, any attempt to exclude the water during the whole of the tide, was what I never considered practicable. A trial was accordingly made to effect the excavation by means of a low wall, composed of clay-rubble, resembling in its object those low dams consisting of logs of wood bedded in clay, which are often adopted in harbor works, and which are only intended to keep out the tide during the first part of the flood, and to be pumped dry before the operations of the next tide are begun. But after many attempts with this clay wall, it became quite evident that it would not be possible, with its assistance, to carry the excavations to near the level of low-water springs, which was due principally to two causes: *First*, because sand and shingle were, during almost every tide, washed in large quantities over the top of the wall into our excavation pit; and, *secondly*, because the waves washed out the clay from among the stones, so as to render the barrier no longer water-tight.

Being now compelled to set about some other way of carrying on the work, I had recourse to the simple method shortly to be explained, and which more than realized my expectations. Before giving a description of this method, however, it will be interesting, as well as still farther explanatory of the required objects, to quote a few lines relating to somewhat similar difficulties, from a Report upon the Harbor of Peterhead, which was drawn up in the year 1806 by the late Mr. John Rennie:—"The next material object of consideration," says the Report, "is that of deepening the harbor, which at present cannot well accommodate vessels drawing more than 12 feet of water in the spring tides, but in neaps is not sufficient. To render this harbor more ex-

tensively useful, it would be advisable to have 17 or 18 feet of water over the greatest part of its bottom, and particularly along the west quay. The mode of performing this kind of work will be different, according to the difference of situation. Those places where the tide ebbs from the surface, and continues so for some time, may be done by blasting, or by loosening the stones with quarrying tools in the usual manner; but *in those parts where the tide seldom leaves the bottom, and in others but for a short time, different methods must be resorted to.* The best of all would be enclosing large spaces by cofferdams, and working at all times of tide by quarrying tools or blasting, as might best suit; but in some situations this would be inconvenient, as the dams would be in the way of vessels going into and coming out of the harbor. In such situations, perhaps the simplest and most expeditious mode would be to use cast iron cylinders, of 7 or 8 feet diameter, having strong canvas fixed to the lower flanch, which might be kept to the bottom by bags of sand in places where there was but little agitation; but where there is much, an outer cylinder might be sunk thereon, to keep them in their situations."

The cylinders proposed by Mr. Rennie were, no doubt, quite adequate to the special purpose and locality for which they were designed, and they unquestionably possess some advantages not to be gained by other means; but, on the other hand, they are attended with difficulties and disadvantages which precluded their adoption in the present case. Those objections were the limited area, the weight and unwieldiness of such cylinders, their inflexible nature and unalterable form, as affording no means in themselves of adaptation to the very irregular rocky bottom which was to be excavated, and what was of as much consequence, the difficulty which must have attended the removal of the *partitions* of rock, or those parts which would necessarily be left between the different compartments of the cutting. The last two objections, it may be remarked, refer equally to wooden caissons, or other contrivances on the same principle.

In the present case, then, the following requisites were to be provided for. In the founding of the talus-wall, all that was required was some method which would enable the found-stones to be laid as deep in the sand as possible, for which purpose the dam did not require to be absolutely water-tight, provided it were capable of excluding from the inside the sand which was so liable to replace what was removed from the interior. For the excavation of the rock, on the other hand, it was necessary that the dam should be water-tight, and suitable for taking out all the partitions; and both situations required piles for fitting close to the irregular bottom, and those piles needed some support other than the soil into which they were to be driven.

To effect such objects, it was clear that the means to be adopted must be at once easily managed and efficient. For although, where there is time for their employment, many complicated and troublesome refinements of construction are forced to answer purposes which might have been attained by simpler means, or by less cumbrous arrangements, yet I was well aware that in the hurry and bustle attending tidal operations and night work, nothing can be tolerated but what is in every respect easily managed and truly efficient.

In the accompanying Diagrams, A G (Plate II.) represents a frame of double waling-pieces connected at the angles by the uprights I I, and bound together by the long bolts L, with forelocks and washers, while E F shews similar double-framed walings for the inside of the dam, and of smaller dimensions, with their uprights D, and connecting bolts K. These frames being placed in the required position, the one frame inside of the other, the piles, C, are driven down between them with heavy malls.

The dam was 12 feet long by 10 feet broad inside, so that five men were able to work in the interior.* If it was to be fixed within low water-mark, the two frames being placed in the water, were guided to the spot by the men in charge, and whenever they were in the desired position, the men at once moored or fixed the frames to the bottom, by driving down a pile at each corner. After this was done, all the piles were placed between the frames and driven down, and keyed up by the small piles called "closers." Four iron jumpers, J, were then driven down to their proper places outside of the frames, and edge planks for retaining the clay were slipped down upon the jumpers through iron staples, which were fixed to the planks. After this, good clay, (which should have some gravel mixed with it, to protect it from the wash of the sea,) was *punned* hard between the planks and the cofferdam, after which the mast N was erected, and the water taken out by means of the iron scoop shewn in the drawing, which not only was used in taking out the stuff, but proved far more efficacious than any pump we ever had. Indeed, to get the dam pumped dry, was for long the greatest difficulty we had to contend with. But Mr. William Downie, to whom I gave the charge, soon removed this difficulty, by using the scoop instead of a pump. The capacity of the scoop was about 37 gallons, and they generally made nine deliveries a minute, so that we found this method greatly more expeditious than any other.

As the excavation proceeded, the piles were from time to time driven down; and when the rising tide began to come over the pile heads, or to rise above the clay, the men, before leaving their work, placed the flooring or "*deck*," as it was called, within the piling, with the ends of the planks resting upon the top of the inner frame. On this deck, ballast (consisting of stones of a convenient size) was deposited, to prevent the whole frame from being floated up,—the quantity so deposited varying with the height of tide, or appearance of the weather. As each compartment of the excavation was completed, and before the dam was removed, the rock below the two rows of piles which adjoined the next cuttings, was completely taken out, and the piles driven down to the bottom of the excavated pit, and left standing.† When the dam was taken up, the frames were, for the next compartment of

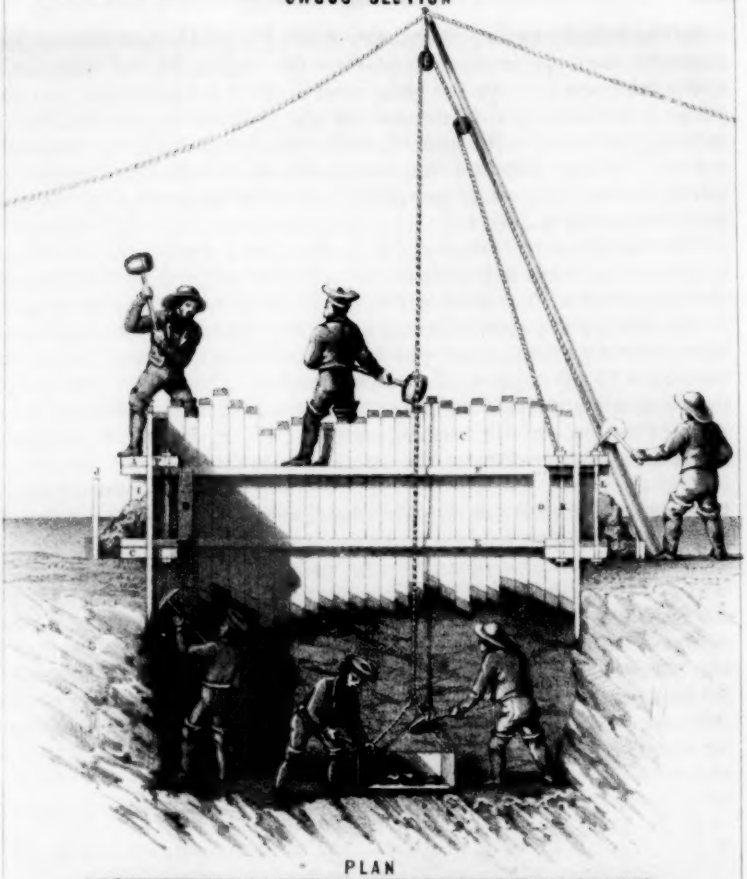
* Since this paper was printed, a cofferdam on the same principle, and 30 *feet square*, has been made for the Forth Navigation works, Stirling, where, in the removal of the "fords," under my direction, much difficulty has hitherto been experienced, from the constant flow of the river.

† Before lifting the cofferdam, the pit was filled with sand, to support the piles that were to remain, which, when the works were done, was cleared out by means of a water-scour provided for the purpose of keeping permanently open the navigable tract.

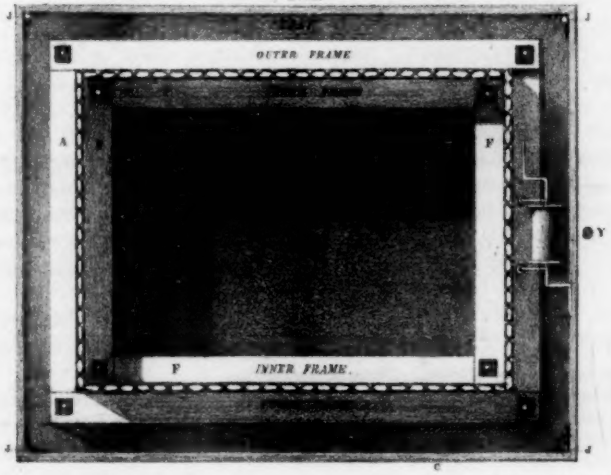
Mr. T. STEVENSON'S PORTABLE COFFERDAM.

SCALE 6 FEET TO 1 INCH

CROSS SECTION



PLAN



Lith. of Wagner & M.Guigan, 20 Chestnut St. Phila.

cutting, again superimposed upon one of the rows which had been left standing in the last pit. In this way no rock could possibly escape being removed; and when the frames were to be put down anew, there was no difficulty (although the pit was entirely covered with sand) in knowing exactly the position which they were to occupy, as the piles which had been left standing were an infallible guide.

The advantages peculiar to this description of dam are its cheapness, —its portability,—its ready adaptation to a sloping, or even to a very irregular bottom,—the ease and certainty with which the partitions between the different pits are removed, and the double-framed walings that support and direct the driving of the piles. Wherever excavations require to be made in a rocky beach, covered by a stratum of sand, however thin, there need not be any hesitation in adopting this form of dam, as there is no kind of lateral support, such as stays or shores, wanted, the structure containing within itself the elements necessary for its stability. It possesses, indeed, all the properties of a caisson, and has the farther advantage of accommodating itself to an irregular bottom.*

I may observe, in conclusion, that although this form of construction is specially adapted to marine works, in the execution of which it has proved a most valuable auxiliary, the same principle might also be carried to a greater extent, and be rendered fit, with little trouble, to answer for a variety of works,—such as underfooting quay walls, founding bridges, and in removing fords or other obstructions from the beds of rivers. The application of *a double-framed waling*, I have also found in itself a very useful application in several situations, and for a variety of purposes. **Edin. New Phil. Journ. No. 89.**

Speed and Power of the Locomotive. (Broad Gauge.)

The working of locomotives with ordinary passage trains is a much better indication of speed and power, and of the accommodation afforded to the public, than anything that can be gathered from a thousand experimental trips. We went down from Paddington to Swindon, one day, by the *Elk*—one of a broad-gauge class engines having 7-ft. driving-wheels, 16-in. cylinders, and 24 in. stroke. They are somewhat heavier than the class to which belongs the *Ixion*, so celebrated for her performances in the experiments instituted under the superintendence of the gauge commissioners. The fastest recorded trip ever made with a passenger train was from Paddington to Didcot (53 miles). The train taken was 50 tons weight, and the time 51 min. 38 sec. The engine employed was the *Lightning*, one of the 8-wheel engines, with 8-feet driving wheels, 18-in. cylinders, and 24-in. stroke. On another day the lighter engine, the *Elk*, driven by T. Simpson, a very careful and experienced man, left Paddington at 10·50·30, with the

* In situations, also, where there is a considerable depth of water, and where, consequently, the frames must be made so as to stand high above the ground, it will be found of great advantage to plank the outside of the frames between A and G. This will not only make the dam more water-tight, but have the effect of binding and strengthening the framework.

usual morning express, weighing 50 tons, and reached Didcot at 11·45·25, performing the 53 miles, therefore—from a state of rest to a state of rest—in 54 min. 55 sec.; a very excellent work indeed for this class of engine. Again, on another day, we went down by the 12 o'clock train. The trip was an extraordinary one. The train consisted of six carriages, two luggage vans, two carriage-trucks and one horse-box—together about 95 tons. The engine employed was the *Bright Star*, with 7-ft. driving wheels, 16-in. cylinder, and 18-in. stroke. She is a lighter engine than the *Elk*, and was built by Messrs. Stephenson. Her original consumption of coke was between 40 and 50 lbs. per mile, but she has been almost completely altered in her proportions. Her boiler has been lengthened, different cylinders put into her, the fire-box enlarged, the lap of the valve altered—in fact she has been made quite another engine at Swindon, and her consumption of coke now averages from 28 to 32 lbs. per mile. With a train of 95 tons, the *Bright Star*, driven by R. Patterson, one of the oldest and best drivers on the line, left Paddington at 12·3·10, and passed West Drayton (13 miles) at 12·20·27, having, therefore, got into speed with this heavy train, and run the 13 miles in 17 min. 17 sec. At the West Drayton station the caution signal was on, and the same signal was given by the policemen along the line till we came in sight of the Langley Marsh station (16 miles) where the red or danger signal was against the driver. As we approached the station the third class down train was seen about half a mile a-head. This we followed at a reduced rate of speed, and arrived at Slough at 12·28·47. The 18 miles were, therefore, gone over in 25 min. 37 sec., although we were kept back at a snail's pace for the couple of miles between Langley Marsh and Slough. The 13 miles from Slough to Twyford were—from station to station—performed in 17 min. 25 sec. With six stoppages, the train reached Swindon at 2·19·20, so that the 77 miles were performed in 2 h. 16 min. 30 sec. The time lost while the train was at a state of rest at the six stations—Slough, Twyford, Reading, Goring, Farringdon-road, and Didcot—was 24 min. 48 sec. The average speed, including all the stoppages, was 34 miles per hour. We believe there are not to be found on the narrow-gauge lines any two engines that would together equal this performance of the *Bright Star.*

London Artizan. No. 17.

Speed and Power of the Locomotive. (Narrow Gauge.)

Some exceedingly interesting and important experiments for testing the speed and power of two classes of recently constructed narrow-gauge locomotives, were made on the Midland Railway, on Thursday, Friday, and Saturday, May 4th, 5th, and 6th. The result of the experiments evidence considerable improvement in the speed and power of the narrow-gauge engines, since the trials instituted under the superintendence of the gauge commissioners, and furnish some exceedingly valuable data for the construction of useful passenger locomotives. The locomotives with which the experiments were made

are new classes, constructed by the old and well known manufacturers, Messrs. Sharpe, Brothers, & Co., of Manchester; and the modern, but enterprising, and scarcely less-known firm of Messrs. Wilson & Co., of Leeds. Two of Sharpe, Brothers, & Co.'s engines employed in the experiments, were No. 60 and 61. They are each of the following dimensions:—the number of tubes is 161, of 2 inches diameter outside, and 10 feet long. The heating surface is 847 feet, and the fire-box 72 square feet: The cylinder is 16 inches, the stroke 20 in., and the driving-wheel 5 feet 6 inches diameter. Two also of Messrs. Wilson & Co.'s engines—No. 26 and No. 27—were employed. They belong to what is called the "Jenny Lind" class. They have each 124 tubes, of 2 inches diameter outside, and 11 feet long. The heating surface is 800 feet, and the fire-box has 87 square feet. The driving-wheel is 6 feet diameter, and the length of stroke 20 inches. Mr. Kirtley, the locomotive superintendent to the Midland Company, conducted the experiments, which took place from the Derby to the Masborough station, about 40¾ miles. Engine No. 60 took the lead, with a gross weight of 100 tons, when the distance was gone over in little less than 49 minutes, or at the rate of about 49 miles per hour; and that the first 18 miles, up 1 in 330, were accomplished in 25 min. 12½ sec, or at an average speed of nearly 43 miles per hour. The steam of the engine was up 2 hours before starting and the water in the tender was, at the time the train left Derby, nearly at boiling heat. Coke consumed was 16 cwts., or 44 8 lbs. per inch, and water evaporated 10,290 lbs. or 257·2 lbs. per mile. "Jenny Lind," No. 27, with 103 tons, followed, performing the journey in 46 minutes, 22 seconds, or at the rate of nearly 52 miles per hour, the first 18 miles up 1 in 330, having been gone over in 22 minutes 44¾ seconds, or at the average rate of nearly 47 miles per hour. The total amount of coke consumed, including getting up steam, was 13 cwts., or 36·4 lbs. per mile. We are unable to state the quantity of water evaporated, the measurement not having been made with sufficient accuracy to warrant us in giving it. The next was the engine No. 51, with a train weighing 101 tons, and performing the distance in 54 min. 23 sec. The total consumption of coke was 16 cwts., or 44·8 lbs. per mile; and the water evaporated, 10,840 lbs., or 271 lbs. per mile. The quantity of water evaporated per lb. of coke was 6 lbs. In the parallel trip with the Messrs. Wilson & Co.'s engine, No. 26, the amount of coke consumed was 12 cwts., or 33·6 lbs. per mile, and the total water evaporated, 10,116 lbs., or 252·9 lbs. per mile. The water evaporated was 7·5 lbs. per lb. of coke—thus the *six feet driving-wheel engine* of Messrs. Wilson & Co., had traveled at an average speed of rather more than 40 miles per hour—viz.: in 20 min. 19 sec.—while the *five feet six inches driving-wheel engine* of Messrs. Sharpe, Brothers, and Co., went over the same ground in 27 min. 55 sec., or at the rate of 39·3 miles per hour. These are considered the best and most conclusive trips on the narrow-gauge line—saying much for the class of engines, No. 27, which performed the distance at an average rate of 52 miles per hour, as above; while an experiment with the *Great A*, an engine built by Mr. R. Stephenson, with only 50 tons, and much

better gradients, performed a like distance at a rate of only 47 miles per hour. Lond. Min. Jour. No. 664.

Resistance to Railway Trains.

Under the head of "Institution of Civil Engineers," in last week's Journal, we gave a report of the discussion on Mr. Gooch's paper on the above subject, on the 16th inst., the paper having been read on the 18th April. In consequence of Mr. Locke having, on the occasion, expressed himself thoroughly convinced that Mr. Brunel and Mr. Gooch were wrong in the belief entertained by them, that they could get a uniform speed of 50 to 60 miles per hour by gravity alone, down the Wootton Basset incline, which is one in one hundred, some carefully conducted experiments were made there on Friday and Saturday, last week. It has been generally assumed that a train, rtaveling at a rate of 36 miles per hour down such an incline, was the maximum uniform speed; and that there was then a resistance, exclusive of the friction of the working parts of the engine, of 22 lbs. or 23 lbs. per ton. The experiments made by Mr. Gooch, and which were conducted under the eye of Capt. Simmons, the Government inspector, would seem to establish facts contrary to this assumption. They were made by the indicator carriage, constructed by Mr. Gooch, and four passenger carriages, weighing together 50 tons. The incline is on an embankment, running into a wide valley, much exposed to the wind; and a strong side breeze blew during the experiments, which proved that a speed of 52·3 miles was obtained per hour, and could usually be obtained, even in such unfavorable weather. How far the conclusions arrived at by these experiments—that the resistance of the atmosphere, on broad-gauge carriages, is not more than 14 lbs. per ton—we shall not pretend to inquire; certain is it, that this low resistance differs very materially from every calculation previously made, and that too by sound practical men, such as Stephenson, Locke, Bidder, Scott, Russell, Wyndham, Harding, and a host of others, who have all been convinced that the resistance is equal to 22 lbs. or 23 lbs. per ton, and against whose opinions we have only that of Mr. Gooch, in support of his theory. These continual experiments on the Great Western Railway, almost daily puffed off in the *Morning Herald*, should be received with caution, as evidently done with a motive; and that motive is to endeavor to lead the public into the belief, that high velocities are not more expensive to railway companies than moderate ones—an idea contrary to all preconceived notions, and well-established mechanical fact; and also, that a broad-gauge is alone capable of securing those high velocities with safety to the public.

Ibid. No. 666.

An Improved Water-Level. *By* P. M. N. Benoit, Civil Engineer.

Translated for the Journal of the Franklin Institute.

Fig. 1, Plate II, represents the level ready for use, and fig. 2, on a scale three times as great, a vertical section of one of the glass tubes,

A, which are placed at each end of the horizontal tube, B. My improvement consists in a little frustrum of a hollow cone, *a b c*, open at each extremity, *a*, and *b c*, fixed in one of the vertical tubes, *f*, of the ordinary water-level, so that the larger base *b c*, of the cone, exactly fits the interior well of this tube; the upper end has an opening of not more than 2 or 3 millimetres in diameter. (·08 or ·09 in.)

It will be easily seen that this opening plays the part of a pierced diaphragm, opposing the rapid passage of the water from one hand to the other, nor can any air collect under the cone while the instrument is being filled with water.

The instrument may be constructed either by soldering such a frustrum of a cone made of thin metal, to the sides of the tube, just below the junction of the glass into the metal, or by sliding it into its place and securing it by packing—or by using a common glass phial whose bottom has the usual conical form—piercing the top of this cone with a small hole, and grinding the outside of the bottom so as to fit the horizontal tube.

The advantages of this instrument are, that while it does not cost any more than the common level, and does not differ from it in appearance or in the mode of using it, it may be carried from one station to another, without dismounting it, and without losing a drop of water, and may be consequently used much longer than the common level, without refilling. Bull. Soc. Enc. Nat. Ind., Jan., 1848.

AMERICAN PATENTS

List of American Patents which issued in the month of July, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Boxes for Railroad Car Axles;* James Tull and S. Norris, Philadelphia, Pennsylvania, July 3.

Claim.—"What we claim as new, and desire to secure by letters patent, is the forming the journal boxes cylindrical on their upper, or on their upper and lower sides, and of combining them with the plummer blocks, so as to allow them and the axles of the respective pairs of wheels, when applied to railroad carriages, to conform themselves freely to the inequalities of the height of the rails on the opposite sides of the track; the whole combination and arrangement being substantially the same with that made known."

2. For an *Improvement in Springs for Artificial Teeth;* George Stuart, Philadelphia, Pennsylvania, July 3.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of forming the spring joint and arms of said instrument, in the manner set forth: that is to say, by the coiling of the middle of the wire, so as to constitute the spring joint, and the extending

of the outer ends thereof, so as, in part, to constitute the elastic arms of the lever, in combination with the cheek plate, operating in the manner and for the purposes set forth, and in combination, also, with the sets of artificial teeth; the whole arrangement of the respective parts being the same substantially with that herein fully made known. And this I claim, whether the respective parts be made in the precise form herein described, or in any other that is the same in its action and results, and attaining the end by means substantially the same."

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3. For an *Improvement in the Injecting Ventilator;* Frederick Emerson, Boston, Suffolk county, Massachusetts, July 3.

The object of the injecting ventilator is the introduction of atmospheric air into the interior of ships and buildings, and into any other places where a continuous supply of pure air is required.

Claim.—"I claim as my invention, and desire to secure letters patent for the combination of the inverted cone partitions, and hollow frustrum or frustrums and tube, as specified, for directing a current of air into the place to be ventilated."

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4. For an *Improvement in the Ejecting Ventilator;* Frederick Emerson, Boston, Suffolk county, Massachusetts, July 3.

Claim.—"I do not claim, simply, the combination of the conic frustrum with a fender above it; but what I do claim as my invention, and desire to secure by letters patent, is so placing the fender above the conic frustrum, as to leave a clear space between the plane of the upper edge of the conic frustrum, and the parallel plane of the lower part of the fender, substantially in the manner and for the purpose specified, whether the fender be a flat disk, or varied from that form, as described."

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5. For an *Improvement in Water Wheels;* J. B. Conger, Jackson, Madison county, Tennessee, July 10.

The patentee says,—"The nature of my invention consists in so forming and arranging the buckets, or vanes of the wheel and shutes, that the water, on entering through the shutes, into a space between them and the wheel, is given a direction and velocity similar to that of the wheel, and a contrary direction, on leaving it, with equal velocity, as relates to the wheel, but without actual velocity; thereby causing the wheel to stop the motion of the water entirely, at the same time that it (the wheel) has a velocity of rotation equal 0·7—that of the water, if allowed to escape freely, being 1."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a wheel and shutes, having buckets or vanes with the top part cycloidal, and the bottom part plain, placed between two concentric rings, using one-half of the cycloid, or nearly so, commencing at or near the curf for the top of the bucket, and making the plain part a tangent to the vertex, as herein described and set forth."

6. For an *Improvement in Steam Engines;* Benjamin S. Benson, Baltimore, Maryland, July 10.

The nature of this invention consists in placing one, two, or more cylinders around the axis of a shaft, parallel with, and at equal distances from it, and connecting the rods of the pistons that work in them, with arms projecting from a shaft, placed at an angle less than a right angle with the axis of the shaft that carries the cylinders, and thus obtain a rotary from the reciprocating motions of the pistons, when the pistons are actuated by steam, &c., or give reciprocating rectilinear motions to the pistons, when the shaft or shafts are rotated by any power, to cause the pistons to act on any fluid as a pump.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a cylinder or cylinders at a distance from the axis of their motion, substantially as described, when this is combined with the connecting of the piston or pistons with the arm or arms, (or their equivalent,) of a shaft, or its equivalent, the axis of motion of which makes an angle less than a right angle, with the line of the axis of motion of the cylinder or cylinders, substantially as herein described."

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7. For an *Improvement in Ships' Blocks;* William W. Hill, Greenport, Suffolk county, New York, July 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming the cheeks of the block circular, with rebates to receive the flanches of a metal head-piece or cap, constructed with flanches to fit the rebates, and with a concave segmental groove, whose highest part, inside, shall be above, or in line with, the top of the wood shell, thereby making a circular shell receive a larger sheave, than the ordinary eliptical shell of the same length can usually do; and I claim the combination therewith of metal straps, passing through the metal head-piece, and into mortises in the cheeks of the shell, instead of into grooves on the inner faces of the cheeks, the straps having holes to receive the pin of the sheave, and such mode of forming, construction, and combination, being substantially as described."

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8. For an *Improvement in Moulding Brick;* Stephen Ustick, Philadelphia, Pennsylvania, July 10.

This invention consists of an apparatus for moulding dry clay, which is pulverized and sifted for that purpose.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the combination of the pistons with the cams in the manner described, said cams being adjustable, and guiding the pistons during the whole revolution of the wheel, substantially as set forth. Secondly, I claim the combination of the revolving screen and pulverizer with the horizontal wheel of moulds, constructed substantially as described. And lastly, I claim, in combination with the double piston moulds, the apparatus for discharging the brick from the mould, and cleaning the face of the pistons, consisting of the vertical piston and cam, arranged as described."

9. For an *Improvement in Printing Presses;* R. M. Hoe, City of New York, July 10.

"The nature of my invention," says the patentee, "consists, in the first part, in operating the sliding frame, that carries the inking rollers over the form of types, by a motion independent of that which operates the frame that carries the frisket and finger bars, so that by a simple change of the cam that gives the motions to the inking rollers, they can be passed over the form of types once or twice for each impression, thereby admitting of a greater number of impressions than can be given when the rollers move with the frisket.

"The second part of my invention consists in so arranging the delivering rollers and tapes, relatively to the location and motion of the frisket, that part of it (the frisket) shall pass between the rollers and tapes, that they may remove the sheet therefrom, and deliver it to the fly frame or other apparatus.

"The third part of my invention relates to the mode of arranging and operating the fingers to grasp the sheet.

"The fourth part of my invention relates to the combination and arrangement of parts for giving the requisite reciprocating intermittent motions to the frame that carries the rollers for inking the form of types.

"And the fifth part of my invention consists in combining with the frisket frame, an arrangement of parts for giving to the frisket the requisite reciprocating intermittent motions."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, giving the inking roller frame, for inking the form of types, its motions independent of the motions of the frisket frame, substantially as described, whereby the range of motion to be given to them can be reduced, more time can be given to the rollers to receive their supply of ink, and the rollers can be carried over the form of types once, twice, or more times, for each impression, as described.

"Secondly, I claim the method of removing the printed sheet from the frisket, by passing a part of the frisket between rollers that remove the sheet, and deliver it to the fly frame or other apparatus for delivering the printed sheets, substantially as described.

"Third. I claim the arrangement of the finger bars, in combination with the inclined planes into which the ends of the forward bar passes, and the lever which acts as an inclined plane to open the fingers, and then rises to suffer the tension of the spring to close them substantially as described.

"Fourth. I claim the arrangement of either of the cams that operate the inking roller frame, the cogged sector, and the train of wheels, in combination with the inking roller frame, substantially as described, whereby I am enabled to attain the required intermittent reciprocating motions more efficiently than by any other means known to me; and

"Fifth. I claim the arrangement of the cam, the sector, and train of wheels, as described, in combination with the frisket and finger frame, in the manner and for the purpose substantially as described."

10. For an *Improvement in Reaping Machines;* William F. Ketchum, Buffalo, Erie county, New York, July 10.

The patentee says,—"The nature of my invention consists in an endless chain cutter, for cutting grain and grass, and the application of it in such a way as will cause it to run around pulleys, with the back of the cutter against them—(the pulleys are fixed on the rack piece of proper length for the width of the swath to be cut)—with the cutter passing round the pulleys, the cutter being covered all but the edge, which comes in contact with the grain or grass."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the endless chain cutter, in combination with the pulleys and rack teeth, for cutting grain and grass as described. I also claim the crooked arm or coupling piece, in connexion and combination with the rack piece and frame as above set forth, for the purposes stated."

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11. For an *Improvement in the Rotary Engine;* Philo C. Curtis, Utica, Oneida county, New York, July 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing a rotary engine of one, two, or more cylinders, crossing and being united to each other at their centres, as also to a solid and hollow axle on which they are suspended, and revolve, by means of heavy pistons placed within the cylinders, and shifted from end to end by steam admitted to the same, through the lower compartment of the tube, and escaping through the upper compartment of the same, through the medium of the side pipes, connecting the ends of the cylinders with the hollow axle, and alternately becoming steam and escape pipes, substantially in the manner set forth."

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12. For an *Improvement in Gearing for Connecting Feed or Pressure Rollers of Planing Machines;* W. E. Cornell and Charles W. Brown, Boston, Suffolk county, Massachusetts, July 17.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of communicating rotary motion, in the reverse direction, from one roller, arbor, or shaft, to another, by means of two auxiliary wheels, whose axes are independent of the frame, so connected with each other, and with the wheels on the axles of the rollers, &c., by jointed links, as to admit of varying the distance between the two rollers, arbor, or shafts, at pleasure, substantially as described. And, in combination with this, we also claim the diagonal link or links, for retaining the auxiliary wheels in their proper position, relatively to the wheels on the axles of the rollers."

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13. For an *Improvement in Changing Gear;* W. M. Davis, Gardiner, Kennebec county, Maine, July 17.

Claim.—"I do not claim engaging and disengaging the shaft and cog wheels by a sliding connecting plate, but I merely claim the mode of

changing the speed of the shaft carrying the article to be wrought, during the operation of the machinery, by means of the combination of the pinions with the shaft, sliding connecting plate, rod, collar, and lever, arranged and operated in the manner before described."

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14. For an *Improvement in Ventilating the Timbers of Vessels;* Ebenezer Knight, Brooklyn, Kings county, New York, July 17.

The nature of this invention consists in making use of the bilge water in vessels, to ventilate the spaces between the timbers and the planking, and the ceiling of vessels, for the purpose of preventing the generation of noxious gases, and preserving the timber, by leaving a free admission for the passage of air through the plankshire, or near thereto, and the salt stops and other obstructions, the motion of the vessel causing the bilge water to flow from side to side, alternately exhausting and forcing out the air, and thus keeping up a free and constant circulation of pure air, the presence of which tends not only to preserve the timber of the ship, but promotes the health of the crew, and adds much to the comfort of ships.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the motion of the bilge water in vessels, induced by the motion of the vessel, in combination with the air passages operating to the atmosphere, and the openings in the salt stops, when such are used, for the purpose of ventilating the spaces between the timbers of vessels, for the purpose and substantially in the manner described."

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15. For an *Improvement in Couplings for Railway Cars;* William C. Bussey, Rockgrove, Stephenson county, Illinois, July 17.

The patentee says,—"The nature of this invention and improvement consists in combining and arranging within a suitable cast iron box, (having an open flaring mouth,) an eccentric notched tumbler, a roller, and a dog, turning on round pins inserted into the front and back plates of the box, and a spring or weight, for holding the dog in gear with the tumbler, arranged and operating in such manner that, when a car to which the coupling bar is attached, approaches a car to which the box is affixed, the head of the coupling bar enters the mouth of the box, passes between the roller and tumbler, strikes the tail of the tumbler, causes it to turn on its axis, and brings a convex protuberance thereon into the concavity of the coupling bar, forming its neck, and, at the same time, the dog into the notch of the tumbler, by the action of the spring, or by a weight, by which the coupling is effected—the said dog having an extended tail affixed to it, reaching through a mortice in the edge of the box, for the purpose of striking against the appended car, when the car to which the box is affixed may be suddenly thrown or turned from its track, by which the dog becomes disengaged from the tumbler, and the cars detached by the turning of the tumbler on its axis, which allows the head of the coupling bar to pass freely from the box between the roller and tumbler;

by which arrangement and operation the apparatus becomes self-acting, there being provision made for a similar box and coupling apparatus on the appended car, having the tail end of the dog extending through the box on the opposite side, so that should the cars turn off the track on that side, the separation may take place in a similar manner to that described;—the box and all the parts contained in it being cast of iron or other suitable material, except the spring, which is made of good cast steel—the two boxes and their contained coupling and uncoupling apparatus for each coupling bar being made in a similar manner, and the coupling bars being made alike at both ends, namely, each end having a head and neck formed thereon, for the purpose of connecting two adjacent cars, said coupling bars being made entirely of wood or iron, or of both combined."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is coupling and uncoupling cars by means of an eccentric tumbler, revolving roller, turning dog and coupling bar, constructed and arranged, and operated substantially in the manner and purpose above set forth, the coupling being effected by the motion of the car."

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16. For an *Improvement in Cultivators;* Alanson T. Odell, Royalton, Niagara county, New York, July 17.

The patentee says,—"The nature of my invention and improvement consists in a certain combination of two double-jointed, hinged, and wheeled wing frames, containing side cultivators, with a central frame attached to the rear end of the tongue, containing a third wheel upon which it is supported, and a central cultivator, so constructed, arranged, and operated, that undulatory land may be cultivated effectually in uniform depths of furrows, without straining or breaking the frames, the cultivators being made to accommodate themselves to the hills and hollows, and other inequalities of the land, by means of flexible central joints or hinges attached to the frame of the central cultivator."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the combination of the two double-jointed, hinged, and wheeled wing frames, containing the side cultivators, with the central frame containing the third wheel, and central cultivator, constructed, arranged, and operated, in such manner, that undulatory land may be cultivated in uniform depths of furrows, without straining or breaking the frames, the cultivators being made to accomodate themselves to the hills and hollows, and other inequalities of the land, by means of the flexible central joints or hinges, attached to the aforesaid central frame.

"2d. I also claim combining a third wheel with the two side wheels, in a jointed, flexible, or folding cultivator frame, made in the manner above described."

17. For an *Improvement in the Process and Apparatus for the Treatment of India Rubber Fabrics;* C. J. Gilbert and Gamaliel Gay, City of New York, July 17.

The patentees say,—"The first part of our invention, which relates to the extracting of the sap, consists in subjecting the raw india rubber or caoutchouc to the action of dry heat, and of steam, of 200 degrees of Fahrenheit's scale, (more or less,) until the foreign matter called 'sap' is thoroughly extracted therefrom.

"The second part of our invention, which relates to the method of heating, curing, or drying india rubber fabrics, consists in subjecting them, when finished, to the combined action of heat and steam.

"The third part of our invention, which relates to the application of sulphur in the process of curing, consists in subjecting the india rubber, or the fabrics thereof, to the fumes of sulphur, or to sulphurous acid gas, either before or when exposed to the heat in the curing process, whether this (the curing process) be effected by heated air or steam, or by both.

"The fourth part relates to the method of removing, from the surface of india rubber fabrics, the peculiar clammy feeling which it possesses after the process of heating, curing, or drying, and consists in exposing the surface of such fabrics to a rapid current of air, which, in a short space of time, removes entirely the clammy feeling so well known to those acquainted with this branch of manufactures.

"And the fifth part of our invention relates to the apparatus for the application of the various parts of our processes, and consists in placing the cylinder which receives the fabrics in a vertical position, that the fabrics may hang loosely from a series of loops; also in heating the cylinder and fabrics within it, to above the boiling point; in combining with the vessel that receives the fabrics, a tube provided with a blower, for the purpose of carrying a rapid current of air through the vessel, and made to connect with both ends of the vessel, and provided with a branch tube or inverted funnel, through which the fumes of sulphur, &c., can be introduced. And finally, in combining the vessel that contains the fabrics with a steam boiler, by means of a pipe, that steam may be made to circulate through the vessel."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, first, the method of seasoning raw india rubber or caoutchouc, or extracting therefrom what is called the 'sap,' by subjecting it to the action of dry or moist artificial heat, separately or together, whereby we are enabled thoroughly to season raw india rubber, and so extract the sap therefrom, in a much shorter time than by exposing to the action of the atmosphere, as described.

"Secondly. We claim the method of heating, curing, or drying india rubber fabrics, made of any compound of which rubber is the basis, by subjecting them to the combined action of dry heat and steam, substantially as described, whereby the steam is prevented from condensing on the surface of the fabrics, and injuring the surface and lustre thereof, and whereby a more perfect surface is produced than when subjected to either dry heat or steam, separately as described.

"Third. We claim submitting india rubber fabrics to the action of the fumes of sulphur, or sulphurous acid gas, preparatory to the curing or drying process, substantially as described, instead of incorporating the sulphur with the rubber, or spreading it on the surface, as described.

"Fourth. We claim passing a current of air over the surface of india rubber fabrics, for the purpose of removing the peculiar clammy feeling left on the surface of these fabrics after the drying process, and which has heretofore been effected by exposure to the solar rays, as described.

"Fifth. We claim the vertical cylinder in which the above processes are carried on, in combination with the movable frame to which the fabrics are suspended, substantially as described.

"Sixth. We claim the method of heating the cylinder which contains the fabric substantially as described, in combination with the method of introducing steam therein, as described.

"Seventh. We claim, in combination with the vessel that receives the fabrics, the tube for the circulation of air, the two ends of which connect with the said vessel, when the said tube is provided with a blower or other apparatus for inducing the current of air through it, and made to pass through a heating apparatus, as described.

"And finally, we claim, in combination with the cylinder and tube, as described, the means of introducing gases or fumes in the said tube, to be conducted to the fabrics in the cylinder, as described."

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18. For an *Improvement in Paring Apples;* J. Bullock, Jr., and Sewall Benson, City of New York, July 24.

Claim.—"What we claim as new, and desire to secure by letters patent, is the following:—

"First, The arrangement of the spring shaft knife, for paring apples upon a drum wheel. Second, The combination of said drum wheel, (with the knife attached,) with the driving wheel, regulated in its operation by the pulley, band, and lever, and brought back to its place of starting by means of the spring and cord, and the whole so arranged as to make the entire operation by one revolution of the driving wheel, as herein set forth."

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19. For an *Improvement in Composition for Fire Brick;* David Cannon and Heman S. Lucas, Chester, Hampden county, Massachusetts, July 24.

The patentees say,—"The nature of our invention consists in compounding soap-stone, clay, and borax, so as to retain and radiate heat, affording protection when applied as a lining to surfaces exposed to great heat."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the compounding of soap-stone, clay, and borax, in proportions as described, or in similar proportions to produce the like result."

20. For an *Improvement in Rotary Printing Presses;* Richard M. Hoe, City of New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, putting the form or forms of type on a movable or permanent segment of a cylinder, which forms the bed and chase, substantially as described, when this is combined with a cylindrical distributing table which occupies another segment of the same cylinder, substantially as described.

"Second, I claim giving to the inking rollers, a movement towards and from the centre of the cylinder that carries the form of types, substantially as described, when this is combined with the form of types and the distributing table, made on one and the same cylinder and of different radius, as described, whereby the inking rollers are adapted to the different diameters of the form of types and distributing table, as described.

"Third, I claim giving to the doctor or fountain roller of the inking apparatus, a slow continuous rotary motion in combination with the ratchet connexion between the roller and the mechanism from which it receives its continuous rotary motion, substantially as described, whereby the ink is more regularly supplied and by which also this supply may be altered when desired, as described, and lastly, I claim the method of securing the form of types on a cylindrical surface with column rules made thicker towards their outer than their inner edge, by connecting these with grooves in the bed by which they are permitted to approach and recede from each other, and at the same time kept down to the same radius, substantially as described, whereby prismatic types can be secured and held on a cylindrical surface as effectually as on a flat surface, as described."

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21. For an *Improvement in the method of giving the Reciprocating Rectilinear Motion to the Bed of the Napier Printing Press;* Richard M. Hoe, City of New York, July 24.

The patentee says,—"The first part of my invention relates to an improved method of giving the rectilinear reciprocating motion required for moving the bed in and out, as an improvement on the 'mangle-wheel movement.'

"The second part of my invention relates to the mode of raising and lowering the cylinder that gives the impression."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of ending and commencing the alternating motions of rectilinear reciprocating movements, and insuring the proper relative positions of the cogs of the racks and wheel when the wheel begins to act on them, by means of the two racks and cog wheel, in combination with the vibrating lever, substantially as described.

"I also claim the method of elevating and depressing the pressing cylinder, by means of the threaded sliding rods that carry the pressing cylinder, in combination with the cogged nuts and sliding bar with a rack at each end, and so arranged that the racks and cogged

pinions can be thrown out of gear, for the adjustment of the cylinder, for the purpose and in the manner, substantially as described."

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22. For an *Improvement in Reacting Water Wheels;* Emanuel Parker, Camden, South Carolina, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining a wheel, having buckets, made in the particular manner described, with a circular tapered water way, or flue, made in the particular manner described, inclining towards the periphery of the wheel, for the purpose of introducing the water to the buckets, at the required angle and quantity, and preventing the main body of the water resting upon the wheel, the core being formed like the frustrum of a cone, and the inner side of the rim sloped or inclined outwardly, at the same angle as the sloped side of the cone, the periphery of said rim being vertical, and the top horizontal, and the buckets between them, the sections of a screw, whose upper ends are made to incline inwards on radial lines toward the core, at an angle of about 10 degrees—the water-way or flue, forming a segment of a circle gradually lessening in depth, from the place of entrance to where the end of the circle nearly intersects the place of beginning, the said flue inclining outward from a perpendicular line, about 20 degrees, so as to pitch the water against the buckets, at that angle, as above described and set forth, causing every bucket of the circle to be acted on simultaneously, the water escaping therefrom in a contrary direction to that at which the water enters, by which the pressure upon the pivot, which causes its rapid destruction is removed, by which the mill is rendered more durable, as herein set forth."

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23. For an *Improvement in Metallic Frames for Piano Fortes;* Timothy Gilbert, Boston, Suffolk county, Massachusetts, July 24.

"My improvement," says the patentee, "consists in applying to said frame and longitudinal bars, transverse or cross bars, which I cast in connexion with the long bars and main part of the frame. I apply beneath the frame, and transversely near the head of it, a deep cross bar which I also cast to the frame, and to the longitudinal bars."

Claim.—"What I claim, is the combination of the cross bars with the longitudinal bars, and straight and curved sides of the main frame, in the manner as described, whereby the said cross bars, serve as supports to the same, in order to prevent their springing out of place laterally, as specified, thus making the frame itself do all the work of supporting the strains of the strings and avoiding the employment of the usual bolts, and wooden frame work (other than the case or frame of the instrument) to which the iron frame is usually confined, the cross bar beneath the frame serving the purpose of an important support to the head of the frame, and also to the sounding board, the end of which is to be attached directly or indirectly to it."

24. For an *Improvement in the Centrifugal Pump;* A. W. and J. H. Von Schmidt, Washington City, District of Columbia, July 24.

"The nature of our invention," say the patentees, "consists, 1st, in the shape and arrangement of the case; 2d, in throwing the water in a tangent line; 3d, the manner of letting the water into the casing (or wheel) between the centre and periphery of said wheel; 4th, the arrangement of the syphon pipe at the end of the discharge pipe, and 5th, the arrangement of the valves, &c."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is taking the water in between the centre of the wheel and the periphery near to the tangential discharge pipe, as described. And this we claim in combination with the descending discharge pipe, in the manner and for the purpose described."

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25. For an *Improvement in Artificial Incubation;* James Cantelo, Citizen of the United States, residing in England, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is so constructing apparatus for hatching eggs, that the heat given to them may be contact heat from above, whilst the lower surfaces of the eggs are kept comparatively at a lower temperature.

"And secondly, I claim the arranging flexible pipes for imparting warmth to the young birds, as herein described."

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26. For an *Improvement in Condensed Air Engines;* Arthur Parsey, Middlesex county, England, July 31.

These improvements in obtaining motive power consists in certain modifications of machinery by means of which compressed air may be employed to work, without a vacuum, pistons, valves, levers, rods, and other appendages, for the purpose of producing mechanical force, and communicating that force as a motive power for driving other machinery."

Claim.—'I claim as my invention the chamber provided with the spring valve or piston, to regulate the elastic force of the air as it passes from the receiver to the cylinder in combination with the induction passage or passages, as described."

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27. For an *Improvement in making Bottles, &c., from Clay;* E. H. and C. J. Merrill, Akron, Summit county, Ohio, July 31.

The patentees say,—"The nature of our invention consists in forming the clay in a mould, by means of a revolving piston on which are spiral channels to draw the clay back as the piston enters the mould, and in such articles as bottles, &c., the inserting the bottoms after the other parts have been made."

Claim.—"What we claim as new and desire to secure by letters patent, is the employment of a core or mandrel after the form of the interior of the article to be made, and having spiral channels cut in its surface, substantially in the manner and for the purpose described.

"We also claim, in forming bottles or other similar articles of clay, the adding the bottoms thereof after the other parts have been formed. And we also claim an interior mandril having a radial arm jointed thereto, as described, for forming the bottoms of bottles and other similar articles, and in combination therewith, the exterior disk, all arranged and constructed substantially as made known, not confining ourselves to the precise modifications herein described, but suiting our arrangements to the articles to be manufactured."

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28. For an *Improvement in Machines for Cutting and Grinding Corn Stalks;* Ezekial Potts, Tredyffin Township, Chester county, Pennsylvania, July 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the knives with the crushing cylinder and cutting box, in the manner described."

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29. For an *Improvement in Cutting Chair and Sofa Backs;* John H. Belter, City of New York, July 31.

The following is extracted from the specification:—

For the better understanding of the description, it is necessary to state that the backs, intended to be cut by the machine, are made separately from the rest of the chair or sofa, and are not attached to the other part until they have been cut into open work.

Claim.—"What I claim is the apparatus for guiding and steadying the saw while giving it any required angle to follow the pattern to be cut, in combination with the adjustable platform and model support, the whole being constructed and arranged substantially as herein described."

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30. For an *Improvement in Tuyers;* L. C. Minor, Saugerties, Ulster county, New York, July 31.

"The nature of my invention," says the patentee, "consists in providing a sunk bottom to the tuyer to receive the dirt, an elevated bridge with cups and points, permitting the whole air chamber to be filled with air and passing out equally on all sides at the same time."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the dishing stop plate with the plate and bridge, by means of the joints, foot, and cups, substantially as described."

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31. For an *Improvement in the manufacture of Gas;* Benjamin F. Coston, Washington City, District of Columbia, July 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the retort, with the vertical branch containing the material for presenting heated surface to the rosin and tar or other substance to be gasified as it descends from the reservoir, as described, whereby the required surface is obtained to insure the

production of gas with economy, and by which also the substance or substances from which the gases are to be produced is compelled to pass over and around the heated surfaces, as described.

"Second, I claim placing the reservoir or vase of crude material above the vertical branch of the retort, and combined with the stove or furnace as described, and connecting the retort and vase by means of a pipe which opens from one into the other as described, by means of which arrangement the weight of the column of rosin and tar in the reservoir aids in forcing down the crude material into the vertical branch of the retort to prevent choking, at the same time employing the heat of the furnace which surrounds the retort to keep the rosin, &c., in the reservoir in a liquid state, as described.

"Third, I claim combining the neck of the retort with the cooler, by extending this vessel (the cooler) entirely around the neck of the retort, and keep its temperature down to the boiling point or below, and thus prevent the tar, &c., from baking in the neck of the retort, as described.

"Fourth, I claim the method of regulating the supply of crude material to the retort by the consumption of gas by combining the hood of the gasometer with the cock or valve of the supply pipe through which the crude material passes to the retort, in the manner substantially as described, whereby the cock or valve is opened by the descent, and closed by the rising of the hood, as described.

"And lastly, I claim the method of condensing and washing the impurities from the gas, by combining with the gas pipe a condenser provided with a sieve for the spray of water and the bent up pipe for the discharge of the condensing water and impurities, without permitting the escape of the gas, as described."

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32. For an *Improvement in Bee Hives;* Oliver Reynolds, Webster, Monroe county, New York, July 31.

"The nature of my invention," the patentee states, "consists in combining with the hive an illuminated chamber, for alluring the bee-moths into it, where they are destroyed.

"Also in constructing the lower hives, each with one side inclined inwards, forming triangular spaces between every pair of hives for the insertion of triangular moth traps. Likewise in constructing the outer case with inclined channels leading from the entrance to the triangular moth traps.

"Also in forming spaces behind and between the vertical parts of the lighting boards communicating with the inclined channels to admit the bee-moth to enter said channels.

"Likewise in forming spaces around the tubes at which the bees enter, to admit the moths to the inclined channels leading to the traps."

Claim.—"What I claim as my invention and improvement, and which I desire to secure by letters patent, is, first, the making the case with the spaces around the entrance tubes combined with the inclined ways leading to the triangular traps, in the manner and for the purpose set forth.

"Second, I claim forming the entrances behind the lighting boards, in the manner and for the purpose set forth; that is to say, by suspending the lighting boards to the front of the case by the screws, which are turned to the right or to the left, for increasing or diminishing said spaces.

"Third, I claim narrowing each hive on one side thereof where it unites with the adjoining hive, so as to form triangular spaces for the reception of the triangular traps, as above described.

"Fourth, I claim forming the moth traps with a horizontal tube, communicating with the interior of the traps and with the inclined channels in the case, arranged and operating in the manner set forth, by which the moths are conducted into the traps, and prevented from escaping therefrom.

"Fifth, I claim the method of separating the drones from the working bees, as above described."

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33. For an *Improvement in Inking Apparatus for Printing Presses;* Richard M. Hoe, City of New York, July 31.

The patentee says,—"The object of this invention is to provide hand presses with an inking apparatus operated by power to insure the proper inking of the form of types, and to save the hard labor heretofore employed for this purpose. The inking apparatus is placed by the side of the bed frame of the press, so that when the bed and the form of types on it is carried out from under the platen, it will be so situated that the inking rollers shall pass from the distributing rollers over it, and back again one or more times, as may be desired. And the nature of my invention consists in giving the requisite reciprocating motion to the carriage of inking rollers, by means of an arm on a vibrating shaft, or arber, connected with the roller carriage by a jointed forked link or bale, the shaft of the lever being provided with a crank arm connected by a joint link with a rotating crank of less length on a shaft below, which receives its motion from another and parallel shaft by two cog wheels that may be shifted to vary the relative motions of the two shafts when it is desired that the inking rollers shall pass a greater number of times over the form of types for each impression, according to the quantity of work desired to be produced, the latter of these shafts being actuated by a worm that rotates continuously by its connexion with the main or driving shaft of the mechanism, and which, to intermit the motions, can be thrown in and out of gear, by having one end of its shaft working in a swivel box, and the other in a sliding box, so that by means of a catch link, it can be thrown into gear when the form of types is carried out to be inked, and thrown out by a cam at the end of the inking operation. And my invention consists also in providing the shaft of the worm wheel with a cam to vibrate a lever provided with a hand catch, to turn the doctor roller the required distance at each operation, to carry up the requisite quantity of ink, and another cam, which by means of a jointed link and lever, depresses the taking roller to receive its supply

of ink from the doctor roller, and then carries it up to transfer its supply of ink to the distributing roller."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mechanism for communicating motion to the carriage of inking rollers, or the mechanical equivalents therefor, in combination with the catch link and lifting shaft, by means of which the parts are thrown in and out of gear, to operate and stop the inking rollers, substantially as described.

"I claim transferring the motions from the shaft of the worm wheel to the rocking shaft, the arm of which is in connexion with the carriage of the inking roller, by an intermediate shaft, the motion being transmitted from one to the other by two spur wheels which may be changed to carry the inking rollers over the form of types a greater or less number of times for each impression, substantially as described."

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34. For an *Improvement in Boiler Furnaces;* Jacob Seaburg, City of New York, July 31.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming of an opening or openings near to the lower part of the ascending flue, in the chimney stack, in combination with the descending flue, substantially as described, to check the draught of the chimney, and thereby to detain the heated gases under pressure within a furnace, in the manner set forth."

List of American Patents which issued in the month of October, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Weaving Fish Nets;* Levi Van Horsen, New Haven, Connecticut, October 7.

The patentee says,—"The nature of my invention consists in weaving fish nets, having flat square knots, and diamond shaped meshes, by means of machinery."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the jaws, the gums, the teeth, and the hooks, for forming an open noose, constructed in the manner set forth.

"I also claim the combination of the sweeps and levers, for forming the meshes; and, in combination therewith, the casts and cams on the shaft, for moving them in regular succession.

"I further claim the combination of the lathe, and frame attached thereto, on which the levers and casts are hung, and suspending the lathe on levers so as to be raised by a treadle, constructed and arranged for the purpose herein described."

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2. For an *Improvement in Horse Powers;* Isaac R. Lawrence, Chatham, Columbia county, New York, October 7.

The patentee says,—"This improvement consists in forming a jointed

railway of parallel plates, twice the length of the links to which said plates are cast, said plates being cast on one half the links, or on every alternate link, and extended beyond the ends of the same half their length, so as to overlap the intermediate link, which is cast without parallel plates, so that as the chain passes around the polygonal drum, and the links are bent at the joints, the said projecting ends of the plates forming the railways, will pass the sides of the said intermediate links without obstruction, the ends of the slats of said intermediate links not extending beyond the outer face thereof, whilst the slats of the links having the parallel plates extend through said links, and between said plates."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the endless chain horse power with parallel plates, nearly twice the length of the links, on the sides of one-half of them, thereby producing one-half the number of joints in the railway that there are in the chain, thereby preventing a sagging at the joints, by means of the said plates extending from the periphery of one of the upper sustaining rollers to the periphery of the next succeeding roller, whilst the joint of the chain is passing from one to the other, and also producing a double railway, the inner series of plates producing a railway for traveling over the upper sustaining rollers, and the outer series of plates a railway for traveling over the lower sustaining rollers, for preventing the chains from sagging in revolving from one side of the machine to the other."

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3. For an *Improvement in Churns;* Daniel F. Hitt, Galena, Joe Daviess county, Illinois, October 7.

The patentee says,—"I prepare a hollow trunk, log, or cylinder, of such capacity as may be requisite for containing the quantity of cream intended to be churned, and this I suspend in a suitable frame, by means of gudgeons placed equidistant from the two ends of the above named vessel, which is to receive a rocking motion on the gudgeons. Under each end of said gudgeons I place a spring, which may be varied in form, and may be made either of wood or of metal. These springs are not to be in contact with the log or vessel that forms the body of the churn, when such vessel stands horizontally, but said body is to be brought into contact with them alternately, when it is made to rock."

Claim.—"Having thus fully described the manner in which I construct my churn, it is to be understood that I do not claim a rocking churn as of my invention, nor do I claim the suspending of the vessel which is to contain the cream, on gudgeons at its centre, the bodies of revolving churns having been so suspended, and the contents having been allowed to fall from end to end, by the rotary motion given to such body; but what I do claim as my invention, and desire to secure by letters patent, is the manner in which I have combined the respective springs with the body of a churn which is to receive a vibrating motion upon gudgeons, by so arranging them as that they shall alternately be acted upon by such vibrating motion, and shall, by their

conjoint re-action in this combination, tend to raise the depressed end of the churn, as herein set forth."

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4. For an *Improvement in Pumps;* B. T. Babbit, Little Falls, Herkimer county, and S. C. Higbee and P. W. Plantz, Openheim, Fulton county, New York, October 7.

The patentees say,—"The nature of our invention consists in constructing two air vessels in connexion with the supply pipe, one on each side, or it may all be in one, as the case may require, for the purpose of giving elasticity to the re-action of water in the supply pipe, so as to not check the velocity of the water while the pump is operating on the dead centres, thereby giving ease to the supply pipe, as, when lead is used, it is subject to be broken or soon chafed off. Also causing the main cylinders to fill much faster than they otherwise could, thereby producing a steady stream from the pump, and a steady and uniform current through the supply pipe while the pump is operating."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of air chambers to the supply pipe of pumps or engines, together with the manner in which the pump is cast, as described."

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5. For an *Improvement in Casting Spoons;* Luther Boardman, Chester, Middlesex county, Connecticut, October 7.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming of such moulds with a main descending gate leading down nearly to the lower end of the spoon, or other article to be cast, where it is to communicate with the proper cavity, by means of a lateral descending gate or sprue, in combination with the sprue above this, and towards the upper end of the cavity for receiving the metal, having an ascending direction; the whole being formed in the manner and for the purpose herein fully set forth.

"And I will here remark, although I have spoken of a single lateral ascending gate, or sprue, leading to each cavity, there may be two or more such lateral ascending gates, without producing any injury, although I do not think them necessary or desirable."

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6. For an *Improvement in Straw Cutters;* Edmund Warren, City of New York, October 7.

The patentee says,—"The nature of this invention consists in twisting a two, three, or four-edged knife to a slightly spiral form or auger shape, or setting knives (edges out) spirally round a rod or shaft and these made to cut against a wooden roller or band. Its nature also consists in an arrangement by which the hopper can be turned down or up at any angle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is,—

"Firstly, the revolving disk, for the purpose of changing the position of the hopper.

"Secondly, the combination of the belt, consisting of hide, leather, or other suitable material, and the two rollers with the cutting knives to form a good and durable surface for the knives to act upon.

"Thirdly, the application of the spiral knives, their backs set to a small round shaft, or, instead, one blade wound evenly round a shaft in a long spiral, and secured at each end with a ring and collar.

"Fourthly, I claim the application to straw cutters of the *spiral cutters,* made of one piece and with two, three, four, or more edges."

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7. For an *Improvement in Saw Mills;* Pierson Crosby, Fredonia, Chatauga county, New York, October 7.

The patentee says,—"The principal improvements desired to be patented, are in the manner of constructing the frame by which it is rendered more portable, less expensive, and more permanent, and in the apparatus for regulating the feeding and for throwing the said apparatus in and out of gear; likewise in the construction of the dogs, for securing the logs."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the fender, posts, and gate at an inclination, as described, in combination with the location of the crank shaft and pitman rods, the former being placed in front of the gate, and the latter being connected with the gate near the top thereof, so that the gate in working shall pass by the crank shaft instead of working entirely above it, and that part of the gate to which the pitman rods are attached, is in a vertical line, or nearly so, over the shaft, all as described."

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8. For an *Improvement in Combing Wool;* Charles G. Sargent, Lowell, Middlesex county, Massachusetts, October 7.

The patentee says,—"I would remark that I am aware that machines for combing wool have been constructed with cylinders and wheels having points or teeth projecting from their surfaces or peripheries, such teeth being generally inserted in the sides of the wheels and consequently standing *parallel* to each other. Therefore I do not intend to claim the use of such wheels or cylinders, but what I consider new and claim as my improvement, is, the *horizontal* cylinder, having its points or teeth arranged as above described, in combination with the vertical wheel of radial teeth; or, in other words, the combined arrangement of the teeth of the cylinders and wheel, as set forth.

"Also, the combination of the cylinders and wheel having their teeth arranged as set forth, the object of one cylinder being to aid in the removal of the wool from the other cylinder, and its deposit upon the wheel.

"Also the combination of the endless guiding band with the wheel of radial points, the same being arranged and operating as herein set forth."

9. For an *Improvement in Cutting Shingles;* Sylvester Munson, Dillon, Tazewell county, Illinois, October 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, the combination of the two gauges when united by a joint or joints, in the middle, and provided with the means of setting them, with the knife, so that by the shifting of the bolt from side to side, the shingles are cut tapering, as herein described."

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10. For an *Improvement in Augers for Boring Earth;* John M. Cooper, Newbern, Green county, Alabama, October 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the hollow tube and grooved cross piece with the boring apparatus so as to keep up a communication between the superincumbent air or water, in the shaft and the under side of the plate, all as herein described."

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11. For an *Improvement in Spark Extinguishers;* James Ecklor, Catskill, Greene county, New York, October 7.

The patentee says,—"The nature of my invention consists in attaching to and enveloping or surrounding the smoke-pipe or chimney with a sheet iron shell, or case with screens attached inside, also surrounding the pipe, and above it, and also the insertion of tubes or pipes into and around the chimney, through which the sparks necessarily rush and fall to the bottom of the shell or case, either immediately upon leaving the tubes, or after being forced through the screen."

Claim.—"What I claim as my invention, is the manner in which the pipes are placed in the chimney, giving direction to the sparks, *and in combination therewith*, attaching the screens to the outside shell, as set forth, so as to produce the effect of arresting the sparks, and causing them to be extinguished, and to fall to the bottom of the shell, or outside case, from which they can be readily removed; and I claim the right to use for such screens, either wire or perforated metal, and to vary the proportions, of any or all such improvements, as different cases may require, without variation of the principles of such improvements."

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12. For an *Improvement in Making Segars;* Jonathan Ball, Buffalo, Erie county, New York, October 13.

The patentee says,—"The nature of my invention consists in rendering the end of the segar impervious to the moisture of the mouth, thus entirely preventing the ill effects of the tobacco to the lips, and at the same time preventing the ill effects of the moisture of the mouth to the segar, without which it becomes saturated, and loathsome, preserving at the same time the draught or passage for the smoke perfectly free and open; the method I employ is to form a composition of gum shellac dissolved in alcohol or any other substance that will dry quick, and is impervious to water."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the solution to the segar which renders it impervious to water or the moisture of the mouth, while smoking."

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13. For an *Improvement in Furnace Stoves;* Stedman W. Hanks, Lowell, Middlesex county, Massachusetts, October 12.

The patentee says,—"When the wood and fire are introduced into the stove and the inner cylinder becomes heated, currents of air enter the holes in the bottom, and passing up between the two cylinders, become heated, and consequently expanded and forced out through the apertures in the top, the register there being open. The inner rim or register on the top being shut, and the cap on the tube and the cricket adjusted to its place, the hot air will pass down the flaring passages, and entering the hollow top of the cricket, come up through the holes in the sheet iron top, so as to afford warmth for the feet."

Claim.—"I claim as my invention the cricket above described, in combination with the stove above described, or with any stove of like construction and principle, by which the heated air is applied for the purpose of warming the feet."

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14. For an *Improvement in Lard Lamps;* Enoch W. Perry, Boston, Massachusetts, October 12.

The patentee says,—"In ordinary lamps for burning oil or concrete fatty matters, the wick tubes are supported in their position in the fountain, by means of a screw inserted in the aperture of the top of the fountain, the wick tubes passing through and being soldered into the screw. The screw is hollowed out so as to form a small cup around the tubes, *for the reception of any oil which may flow from the wick while burning.*

"One part of my invention consists in appending to this screw a deep cup which shall extend *below the screw* (and into the reservoir or lamp).

"The wick tube extends through the cup, its top terminating on or about the level with the top of the cup part of the screw, so that the part of the wick extending above the tube shall be in part or nearly all, within that part of the cup above the top of the tube."

Claim.—"What I claim is, forming the upper part of the wick tube as described, whether the same is used in a lamp for burning concrete matters, or animal, or vegetable oils—or is combined with a screw cup or screw plate for sustaining the same in position."

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15. For an *Improvement in Hydrants;* John L. Chapman, Baltimore, Maryland, October 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I employ the double crank shaft, with its two cranks, so that a weight upon one of the cranks shall

operate with great force in closing the way of the cock, the plug of which is moved by a short crank, connected thereto by a suitable rod; the whole being arranged, combined, and operating substantially in the manner herein set forth. I also claim the manner described of forming the waste water way by means of the holes drilled through the plug of the valve shaft, and through the delivery pipe."

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16. For an *Improvement in Manufacturing Sheet Iron;* James, John, and William Wood, Wilmington, Delaware, October 12.

Claim.—"What we claim as new, and desire to secure by letters patent, is the giving to rolled sheet-iron such a glazed surface by the process, or in the manner set forth: that is to say, by covering the surfaces of the plates, after they have been freed from oxide, with a coating of linseed oil, or with other oil, or fatty matter, or with resinous solutions, making the sheets so prepared into a pack, heating them to redness, and then rolling them in this state, for the purpose, and substantially in the manner above set forth."

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17. For an *Improvement in Bee Hives;* Zachariah R. Hench, Port Royal, Juniata county, Pennsylvania, October 12.

The patentee says,—"The principal improvements I have made in the hive, and for which I solicit letters patent, are in the peculiar construction and arrangement of two glazed side boxes attached to the hive for attracting and securing the bees during the operation of taking the honey, or for colonizing bees; and also for catching strange bees, that come to the hive to rob it, and also in the construction and arrangement of a swarming board for facilitating the increase of the stock of bees; and likewise in the addition of a sliding frame and window with a door and perforated slide stand for ventilating the hive during the operation of catching the strange bees or robbers. And also the addition of ventilators and fumigators to the side boxes for again driving the bees from said boxes into the bee house, said fumigators being also used as side ventilators for supplying air to the side boxes during the operation of smoking the bees from the hive into the side boxes—by means of a common bellows, acting on both side fumigators at the same time, by having a branched tube extending from a central pipe, into which the nozzle of the bellows is inserted to each fumigator."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the glazed side chambers, fumigators, and ventilators, and funnels, with the glazed stand, constructed, arranged, and used in the manner described."

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18. For an *Improvement in Cutting Sausage Meat, &c.;* John H. Potts, Fayette, Howard county, Missouri, October 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the rhomboidal knives, fixed on

the upper or outer edges of the wedge-shaped projections at the centre of the concave revolving disk for cutting the meat into small pieces as it enters the machine from the hopper, in combination with the several series of fixed triangular knives, arranged in the dove-tailed slides of the cheek for cutting the meat into finer particles, in the manner herein set forth."

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19. For an *Improvement in Raising Bread;* Abel Conant, Lowell, Middlesex county, Massachusetts, October 12.

The patentee says,—"The nature of my invention consists in using tartaric acid, cream of tartar, citric acid, alum, or any other known acid in a dry state, or any compounds of acids, or any compound of which acid, or acids, is a principal ingredient, in a dry state, and mixing the dry acid, or acids, or the dry compound in a dry state, with dry flour, and in dissolving saleratus or other alkali, in a sufficient quantity of pure water, *sweet* milk, or other liquid, to neutralize the acids in the flour and to make it into dough, and in raising the flour, acids, alkali, and liquids thus prepared, into good dough, and in thoroughly kneading the dough so made, and making it into small loaves or rolls, and baking *immediately*. Or if other pastry than bread, in cooking *immediately* in the usual way, after the dough has been prepared, substantially as above stated."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the *manner* of *using* as herein described, *dry acids* or compounds of *dry acids* thoroughly mixed with *dry flour* or meal, and a solution of alkali in water, sweet milk, or other liquid with which the flour or meal is to be made into dough, for the purpose of puffing up or raising the dough, so that when cooked it will make good light bread or other pastry, without destroying the sugar, or the flour, or meal."

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20. For an *Improvement in Machinery for Pressing Bonnets;* Richard Murdock, Baltimore, Maryland, October 12.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before-described improvements on my patented machinery for pressing bonnets, hats, &c.: that is to say—

"First, Combining the metallic frame of the box iron with the elevated counter balance and curved arm or stirrups, by joints, as herein described, or by other means substantially the same, so that the operator can give to the iron any direction required.

"Second, Suspending the weight to the box iron frame by means of the curved arm or stirrups, or other analogous device, thus increasing the pressure of the iron on the bonnet or other article to be pressed, as before described.

"Third, Making the bearings of the spindle and the groove for the wheel in a jointed and adjustable frame or seat, as described, by which the inclination of the spindle and hat placed thereon can be changed,

whether constructed precisely in the manner herein set forth or in any otherway substantially the same."

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21. For an *Improvement in Ploughs;* William C. Pagett, Greene county, Ohio, October 17.

The patentee says,—"The improvement is intended in the first place for the cultivation of young corn and small plants of every description—throwing *against* them the fine dirt turned up in running a furrow, and *throwing from* them all the clods and stone, and thereby preventing them from being covered up. In the second place it answers in all respects the purposes of the common shovel plough by removing the arm and guard."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the guard, and the combination therewith of the mould board, as the same are herein fully described together with their operation. The invention of the common shovel plough is of course disclaimed."

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22. For an *Improvement in Door Locks;* Albert Bingham, Boston, Massachusetts, October 17.

The patentee says,—"The nature of my invention consists in applying a check bolt to the knob on the inside of the door, in such a manner that the same will intercept the latch bolt, and thus operate as a fastening; the said check bolt being movable by a key, or otherwise."

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of a check bolt, movable by a key, to the knob, in the manner and for the purpose set forth."

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23. For an *Improvement in Flattening and Tempering Window Glass;* John J. Adams, Winslow, Gloucester county, New Jersey, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the movable or revolving tempering platform with its appendages, (either separately or in combination with the revolving flattening platform,) and also the series of grates for laying the glass upon; all of which is constructed and operated as herein set forth."

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24. For an *Improvement in the Manner of Constructing, Propelling, and Turning Steam Ships;* Robert L. Stevens, City of New York, October 17.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the so forming of a vessel as that the after part of the hull shall terminate in one or two cones, in the manner set forth, the after part of such cone, where it equals one-third or one-half of the whole diameter of the propelling wheel, more or less, constituting the

central portion of a spiral propelling wheel, revolving with it and being sustained and driven by a shaft extended forward through the axis of the stationary part of the cone; the whole being constructed and operating substantially in the manner and for the purpose herein set forth.

"Secondly, I claim the turning of a vessel round, either side to, by the passing of a hollow tube through the hold of such vessel, towards either of her ends, in the manner set forth, and by causing a current of water to pass through said tube, in either direction, by means of a spiral propeller, made to revolve within said tube, as herein fully described."

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25. For an *Improvement in Shearing Cloth;* James Pitts, Smithfield, Providence county, Rhode Island, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a rest or bar, in combination with the shear of a cloth-shearing machine; whether the shear be rotary, vibratory, or operating in any other manner, as described."

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26. For an *Improvement in Vegetable Cutters, &c.;* Henry Hoover, assignee of Martin Stoner, Waynesboro, Franklin county, Pennsylvania, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the knives between the disks, in combination with these and the rollers as before described."

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27. For an *Improvement in Manufacturing Sheet Iron;* Simeon Guilford, Lebanon, Pennsylvania, October 22.

The patentee says,—"The nature of my invention and improvement consists in finishing sheet iron with a clean surface, similar to the Russia sheet iron."

Claim.—"What I claim as my invention and improvement, and wish to secure by letters patent, is the finishing of sheet or thin rolled iron free of scruff or oxide (with which the sheet iron finished by the old process is covered) by means of acid and friction for cleaning and burnishing the surface before the manufacture of the article is completed, together with the combined effect of the particular degree of heat used to complete the process, substantially as set forth."

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28. For an *Improvement in Propellers;* John Laing, Ellicott's Mills, Ann Arundel county, Maryland, October 22.

The patentee says,—"My propeller is of that kind which is known under the name of the spiral, and consists of a shaft which is to be placed in the direction of the vessel's length, and has on it a number of flights, or buckets, each of which approaches in form a segment of a spiral, but which are so arranged as not to act upon the water in the manner of those propellers, the spirals of which are continuous.

"The distinguishing feature of my propeller is the employment of a double set of spiral segments, flights, or buckets, the inner edges of one set of which are within a short distance of the shaft, and the outer edges of which terminate at a distance therefrom, which is on a line, or nearly so, with the inner edges of the larger set. The two sets of buckets may be equal in width, and supposing each set to form a continuous spiral around the shaft, the width of the larger would, in such case, be double that of the smaller spiral. The buckets of the larger series are supported on arms which extend out at right angles from the shaft. Each of these larger buckets may be a quarter of a circle in length, or nearly so, and they are to stand in pairs, one opposite to the other, their supporting arms being in the same right line. In the intervals between these, stand a pair of smaller buckets, which may also constitute a quadrant of a circle, or nearly so; these are sustained by short arms proceeding from the shaft. The second pair of larger buckets have their supporting arms at right angles to the first pair, and are placed at a suitable distance from them, which is such that their outer ends shall be at the same distance from the shaft, and the same may be said of the successive pairs of smaller buckets."

Claim.—"What I claim as constituting my improvement in the propelling of boats, and other vessels, is the forming and arranging of the buckets, or flights, of a spiral propelling wheel, in the manner herein set forth: that is to say, with alternate pairs of large and small buckets, so proportioned to each other, as that the outer edge of a small pair shall be in a line, or nearly so, with the inner edges of the larger wheels; and that the outer edges of each set shall stand in the direction of continuous spirals; the whole being otherwise combined together, substantially in the manner herein set forth."

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29. For an *Improvement in Daguerreotype Pictures;* John Plumbe, Jr., assignee of Daniel Davis, Boston, Massachusetts, October 22.

Claim.—"What I claim as my invention and discovery, and which I desire to secure by letters patent, is depositing metals, from their solutions upon the daguerreotype pictures for the purpose of giving them the desired tint, by connecting the pictorial plates with the negative pole of a galvanic battery, or magnetic electrical machine, and immersing them in the above solutions, or any other known solutions of metals, in the manner described, or any other substantially the same.

"I also claim in combination with the above process, the mode of tinting certain part, or parts, of the pictures, all as herein set forth."

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30. For an *Improvement in Lard and Oil Lamps;* F. H. Southworth, City of Washington, District of Columbia, October 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming a slot or perforation in the tube for allowing the lard or oil inside the wick to come in direct contact with the inner additional tube, for the purpose described, in combination with

the skeleton cylinder or conductor, for liquidizing and keeping the lard, outside the wick, in a liquid state."

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31. For an *Improvement in Rat Traps;* Ebenezer Oliver, Philadelphia, Pennsylvania, October 22.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forcing of the rat, or other animal, into the apartment within which it is to be detained, by means of a revolving door, operated upon by a spiral, or other spring; the said door and spring being so combined with a platform, and other appendages, as that they shall co-operate in effecting the intended purpose, by an arrangement of parts, substantially the same with that herein described."

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32. For an *Improvement in Trusses;* Edmund Landis, Lancaster, Pennsylvania, October 22.

The patentee says,—"The nature of my invention consists in the addition of a sleight spring, or springs, to the main spring of a truss, which passes round the body, as described."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the long spring with the main spring of the truss, to maintain an equal pressure on the rupture during every motion of the body, in the manner and for the purpose herein described.

"I also claim in combination with the springs, the spring adjusted by a screw, constructed and arranged as above described. I further claim the combination of the blocks placed obliquely on the abdomen over the inguinal canal, with the horizontal spring for giving a perpendicular pressure upon the parts affected."

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33. For an *Improvement in Hemp Breaking;* Charles Learned, St. Louis, Missouri, October 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of combining the machine for whipping or cleaning with the heckling, so that the flax or hemp can be passed from one to the other by simply sliding it on the spring rest board, as described, by attaching the cleaning knives and heckling pins to the same drum, in the manner described."

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34. For an *Improvement in the Reaction Steam Girator;* Louis Brutier, City of New York, October 25.

The patentee says,—"The main acting part of my engine consists of two arms of equal length, which are to be made to revolve in a vertical plane, said arms being placed upon an axis running horizontally, on suitable bearings.

"One of the revolving arms carries a small steam engine, which is to be supplied with steam from any suitable boiler or generator. At the outer end of each of these arms is what I denominate a steam receiver, into each of which steam is to be alternately admitted, and from which it is to be discharged in successive jets, instead of in con-

tinuous stream, as has been the practice with other reacting steam engines. The small steam engine which is carried by one of the arms, is a cylinder engine, and serves to open and close the orifices by which steam is admitted into, and those by which it is discharged from, the receivers, each of them having one orifice for its admission, and another for its discharge, the whole being furnished with slides so arranged, as that when the steam is being admitted into one of the receivers, the orifice for its discharge shall be closed, and that the action of the two receivers shall be reciprocal in this respect. The steam is supplied to them from the same boiler which supplies the small boiler.

"One end of the shaft which sustains and carries the revolving arms is made hollow, for the admission of steam to the engine cylinder, and to the receivers, its hollow end being received within a steam chamber which is supported on the frame work of the machine, and is connected by a steam pipe with the boiler."

Claim.—"What I claim as new, and desire to secure by letters patent, is the obtaining of the rotary motion of the arms of said machine by the successive and rapid discharges of steam through orifices, which orifices are made in steam receivers, and governed by valves, the supply of steam, and the reciprocal action of said valves, being effected and regulated by an arrangement of parts, substantially as herein made known. I also claim the employment of a small steam engine, attached to one of the revolving arms, and so connected and combined with the valves in the receivers, as to cause them to regulate the admission of steam into, and its discharge from, said receivers, for the purpose, and in the manner described. I will here observe that I have, in the first instance, claimed the manner in which I have constructed the receivers with their valves, for the supply and discharge of steam in successive instants, separately and distinctly from the claim to the employment of the small steam engine for opening and closing the valves in the receivers; and this I have done because I am aware that by means of tappets, or other devices, attached to the frame work of the engine, or to the case which surrounds it, the said valves might be made to open and close without the aid of the said steam engine, though not as I believe with equal advantage."

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35. For an *Improvement in Tenoning Machines;* William H. Harn, Chambersburg, Franklin county, Pennsylvania, October 26.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of constructing the said machine under the particular arrangement of the respective parts: that is to say, a machine in which the tenon is cut, by means of a vibrating plane, formed in the manner of a pilaster, or raising plane; and in which the stuff is held against the face of a sliding block, by means of a frame or holdfast, of iron, the apparatus being formed and operating in such manner as that the cutting shall be effected on the side of the stuff, as set forth. I claim, also, the manner of combining and operating the holdfast, for the purpose herein made known.

"I likewise claim the manner of gauging the shoulder of the tenon,

by means of the adjustable gauge piece; the whole instrument being constructed and arranged as herein described."

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36. For an *Improvement in Horse Powers;* Albert W. Gray, Middletown, Rutland county, Vermont, October 26.

The patentee says,—"My horse power is of that kind which is actuated by the walking of the animal on an inclined plane formed in sections, which sections are hinged together, so as to constitute an endless floor. My principal improvement consists in the particular manner in which I construct the hinges, or connecting links, by which the sectional pieces constituting the floor are connected with each other, and in the manner in which I regulate the inclination of the floor, and support the same."

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I have formed and connected the hinges, or links, with their racks; said hinges extending from side to side, and from edge to edge, of each of the sectional pieces, constituting the movable floor, and the bolts passing through three pair of knuckle joints in each, and being otherwise constructed and arranged, as set forth."

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37. For an *Improvement in Cutting Veneers, &c.;* John Humphreys, Harrington Township, Bergen county, New Jersey, October 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the parallel longitudinal adjustable knives for determining the width of the veneers or other thin pieces of wood to be cut, and the arrangement of the transverse parallel revolving knives for determining their lengths, in combination with the fixed blade for cutting the thin pieces of wood or veneers as deseribed."

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38. For an *Improvement in Separating Garlic from Wheat;* Samuel Fahrney, Boonsboro, Washington county, Maryland, October 26.

The patentee says,—"The nature of this invention consists in passing the wheat and garlic over inclined yielding surfaces, which surfaces shall have a pressure, by means of springs, on the grain, &c., sufficient to mash the garlic, or force it into cavities, but shall yield to the wheat and allow it to pass without disfiguring, and then by means of scrapers, or fingers, distributing the two in separate boxes.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the above described mode of separating garlic from wheat by means of the saw teeth formed on the edge of the plate, and spring bars for mashing the garlic into the apartments of said boxes, or any other mode substantially the same; and in combination therewith, the hopper, arranged and constructed as described."

39. For an *Improvement in Water Wheels;* William Miles, Boonsboro Washington county, Maryland, October 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of raising and lowering the wheel, by means of the cog wheels, lever, windlass, pulleys, and ropes, as described. Also the inclined arms with the floats, arranged in the manner and for the purpose set forth."

The Law of Patents—On an Improvement in the Machine for Pressing Palm Leaf Hats.

In the Circuit Court of the United States, (Boston, Massachusetts,) Chester Gorham *vs.* William Mixter *et al.*

This was an action on the case for an alleged infringement of a patent, for "an improvement in the machine for pressing palm-leaf hats."

The defence set up was—1st. That defendants had not infringed; or, in other words, that the machine used by them was substantially different in its construction and mode of operation, from the machine described in plaintiff's specification of claim in his letters patent.

2d. That plaintiff was not the original and first inventor of the machine patented, but that the same was known and used prior to his supposed invention thereof.

The plaintiff made application in the autumn of 1839, and obtained his letters in March, 1840.

The history of the art of pressing in this Commonwealth, so far as it was known to witnesses, was traced from 1830 to the trial.

In 1830, the machine in general use had three blocks for the hat, with a lever and flat to each, and the pressing of the rim, crown, and top of the hat was performed separately, at three successive operations on the respective blocks by removing the hat from block to block.

These blocks were attached by revolving shafts, which were moved by hand or any other power, as circumstances dictated; and the levers to which the pressing flats were attached were arranged, and the pressing done by hand.

In 1832, the plaintiff made an attempt to improve upon the old machine. He constructed a machine in which but one block was used, and made an angular flat to fit the side and top of the hat at the same time, thereby pressing the whole hat without removing it from the block. It did not appear in evidence, however, that by this arrangement the whole hat was pressed at one operation, without a change of flats.

A similar machine to the last, though somewhat improved in its structure, was shown to have been put in operation in 1834, by one Brown, of Dana, Mass., used for a time and abandoned.

Also, one Charles Rice, of Boston, testified for the defence, that in 1835 he constructed a machine of the same general character, using one lever and one flat; that in 1836 he added the second lever and

flat, making the two answer the purpose of the three flats; and in 1838 he added the third lever and fourth flat.

In this machine, the block shaft was turned, and the levers operated by hand, but the whole hat was pressed without changing flats.

In 1837, the plaintiff invented and put in operation a machine with one block, three levers, and the same number of flats, by which the hat in all its parts was pressed by one operation. The shaft was moved by water power, and the levers to which the flats were appended, were fastened by a catch, so as to press upon the hat while it revolved in connexion with the shaft, thus dispensing with the power of the operator and in a measure acting automatically.

In the machine patented by the plaintiff, four flats, two for the rim on opposite sides, one for the side of the crown, and one for the top, are attached to a sliding frame, which by means of a lever is brought to and removed from the hat-block at pleasure.

The hat is placed on a block with a table for the rim, on a vertical rotating shaft. After the hat is placed, the sliding frame is brought forward by means of the lever, bringing all the flats to their relative and proper position, over and against the hat. Then another lever is disengaged from the catch, which permits a weight to act upon a third lever, which in its turn acts upon the vertical shaft surmounted by the hat, and brings the hat in contact with the flats while the shaft revolves and thus the pressing is performed. After being thus put in motion, no further attention from the operator is required, until the hat is sufficiently pressed. One man can operate three or four machines at the same time, pressing from twelve to fifteen hundred hats per day, while on the old machine, one man could ordinarily press but five hundred in a day.

This machine, and what the plaintiff contended were modifications of it, came into general use soon after its construction, and superseded all that had gone before.

The defendant claimed that the modification used by them was an original invention of one Paul Hildreth, formerly of Petersham, made subsequently to plaintiff's invention and patent.

This was denied by the plaintiff, who insisted that it was taken from his machine, with alterations and modifications, for the purpose of evading the patent; but under the ruling of the court, it was immaterial as affecting plaintiff's right of recovery, whether an original invention or otherwise, being subsequent in point of time to plaintiff's invention and patent.

The point most strenuously urged by the defendants was, that their machine differed substantially from the one patented by plaintiff, and on this point, under the ruling of the Court, the case turned.

The question arose what plaintiff had claimed and patented,—whether a machine, *as* a machine, new in its structure as a whole, or merely a new combination of old parts; and if a combination merely, whether a combination effected by any mechanism, or a combination effected by *the* means, and operating in the particular manner described in his specification of claim. If the latter, the question of priority

of invention was disposed of, for it was not pretended that any prior machine contained the same combination *constructed* and *operating* in the same way.

But it was contended on the part of the defendants, that if this construction were given to the claim, they did not infringe, as some of the elements of combination in their machine were constructed and operated substantially different from corresponding elements in plaintiff's.

On the question of identity of machines, the plaintiff called as experts Thomas Blanchard and R. H. Eddy, of Boston, and the defendants called Charles M. Keller, of New York city.

SPRAGUE, J., charged the jury, that the plaintiff had claimed and patented a combination, constructed and operating as described in his specification, and to that he was limited; that to constitute an infringement, the defendant must have used the same combination, constructed and operating substantially in the same way; that if they had only used two of the three elements of combination, it was not an infringement. Nor was it an infringement, if any one or all their elements of combination were constructed and operated substantially different from plaintiff's.

Yet a mere change in form or proportion, or substitution of mechanical means or equivalents, in any one or all the elements, producing the same result, would not constitute a substantial difference within the meaning of the patent law. Nor would it be a defence, that they had added to the combination, or any element thereof, and made improvements, provided they used plaintiff's combination, constructed and operating substantially in the same way.

Such additions and improvements, though meritorious, gave them no right to appropriate what belonged to another without making compensation. It was for the jury to say, in view of the evidence, under the instructions of the Court, and from an inspection of the models before them, whether the defendants' machine did in fact contain the combination claimed and patented by plaintiff, constructed and operating substantially in the same way.

The jury returned a verdict for the plaintiff, and assessed damages at $1110—$10 of which was for the use of machines, and $600 for counsel fees.

Rufus Choate and H. E. Smith, for plaintiff. B. R. Curtis and Cyrus Cummings, for defendants.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. *By* M. V. REGNAULT.

SIXTH MEMOIR.

On the Compressibility of Elastic Fluids.

(Continued from page 196.)

Tables of the Results of the Experiments upon the Compressibility of Elastic Fluids.

In the first column of the table is placed the number of the experiment.

The second column gives the temperature of the water in which the tube containing the gas was immersed.

The third column records the volume of the gas expressed in grammes of mercury. These volumes were reduced, by calculation, to the temperatures given in column 5, which differ very little from the observed temperatures in column 2. This change was made to facilitate the comparison.

In column four are given the elastic forces of the gas expressed in columns of mercury at 0°, the corrections before indicated having been applied to them.

The experiments in the same series having been made upon the same quantity of gas, the numbers of the vertical columns 3 and 4 may be combined in any order, provided the volumes V are at the same temperature, which may be ascertained by consulting the column No. 5. The second parts of the tables contain the results of these combinations. All possible combinations could not be calculated on account of their number, but those used were taken at random.

Column No. 6 contains the numbers of the experiments combined.

Column No. 7 contains the ratio of the volumes, $\frac{V_0}{V_1}$.

Column No. 8 contains the inverse ratio of the corresponding elastic forces, or $\frac{P_1}{P_0}$.

In columns Nos. 9 and 10 are recorded the quotients obtained by dividing the ratio $\frac{V_0}{V_1}$ by the corresponding ratio $\frac{P_1}{P_0}$. These quotients are placed in No. 9 when the volumes of the gas were nearly as 1 to 2; and in No. 10 when they were in any other ratio.

If then the law of Mariotte be true, the numbers in columns 9 and 10 should be always 1; whereas for atmospheric air it is always greater than unity, and increases very regularly as the elastic forces become greater.

TABLE 1.—*Compressibility of Atmospheric Air.*

1	2	3	4	5	6	7	8	9	10
Number of the Experiment.	Temperature of the Water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
1	4·44°	1939·69	738·72	4·44°	1— 2	2·001215	1·998389	1·001414	
2	4·41	969.26	1476·25	4·44					
3	4·40	1939.69	738·99	4·40	3— 4	1·999990	1·997076	1·001448	
4	4·40	969·86	1475·82	4·40					
5	4·40	1940·21	739·07	4·40	5— 6	2·000010	1·997565	1·001224	
6	4·41	970·10	1476·34	4·40					
7	4·43	1939·47	739·19	4·43	7— 8	2·000701	1·997863	1·001421	
8	4·44	969·39	1476·80	4·43					
9	4·64	970·63	4209·48	4·68	9—10	1·998135	1·992625	1·002765	
10	4·64	1939·45	2112·53	"					
11	4·68	970·57	4208·97	"	11—12	1·998732	1·993232	1·002759	
12	4·68	1939·91	2111·63	"					
13	4·68	970·00	4212·14	"	13—15	1·998705	1·993714	1·002503	
14	4·71	642·78	6350·33	"	12—14	3·017955	3·007302	"	1·003539
15	4·74	1938·74	2112·69	"	14—15	3·016180	3·005803	"	1·003452
16	4·70	642·87	6350·35	"	15—16	3·015758	3·005813	"	1·003309
17	5·03	969·32	4127·82	4·88	17—18	2·001258	1·995851	1·002709	
18	5·03	1939·88	2068·20	"	18—19	2·000158	1·994725	1·002724	
19	4·96	969·86	4125·49	"	20—21	2·002485	1·996491	1·002713	
20	4·96	969·86	4125·13	"	21—22	2·002629	1·997580	1·002528	
21	4·96	1942·13	2066·19	"					
22	4·88	969·79	4127·38	"	23—24	1·997287	1·991516	1·002898	
23	4·85	969·90	4126·86	"					
24	4·85	1937·16	2072·22	"	24—25	1·996143	1·991643	1·002762	
25	4·85	969·97	4127·12	"					
26	4·89	979·87	8177·48	4·91	26—27	1·981270	1·974845	1·003253	
27	4·91	1941·39	4140·82	"	27—28	1·981556	1·975456	1·003090	
28	4·91	979·73	8179·92	"					
29	4·91	979·73	8178·09	"	29—30	1·980045	1·973530	1·003302	
30	4·91	1939·91	4143·89	"					
31	4·90	970·64	8404·11	4·90	31—32	1·998588	1·991944	1·003336	
32	4·90	1939·91	4219·05	"	33—34	1·999690	1·992726	1·003495	
33	4·87	970·18	8407·75	"	35—36	1·998726	1·992084	1·003335	
34	4·87	1940·01	4219·22	"	39—38	2·000050	1·993179	1·003448	
35	4·95	1939·48	4219·05	"					
36	4·96	970·36	8404·70	"	35—37	3·093714	3·076985	"	1·005437
37	4·90	626·91	12981·95	"	37—39	3·094512	3·076964	"	1·005703
38	4·87	969·97	8409·38	"					
39	4·88	1939·98	4219·08	"					
40	4·86	1939·86	6770·15	4·80	40—41	2·000143	1·991607	1·004286	
41	4·80	969·86	13483·48	"	43—44	2·001117	1·990148	1·004512	
42	4·84	685·11	19002·13	"	44—45	2·001454	1·992293	1·004599	
43	4·85	970·03	13468·33	"	48—49	1·996511	1·987409	1·004580	
44	4·73	1941·15	6767·50	"	40—42	2·831456	2·807490	"	1·008536
45	4·74	969·87	13482·84	"	42—44	2·833341	2·808590	"	1·008813
46	4·74	674·81	19312·50	"	44—46	2·876588	2·853713	"	1·008016
47	4·74	675·49	19291·33	"	47—49	2·871502	2·848530	"	1·008064
48	4·73	971·53	13459·49	"	46—49	2·874395	2·851656	"	1·007980
49	4·72	1939·67	6772·38	"					
50	4·81	1942·20	6387·41	4·81	50—51	2·001463	1·992273	1·004611	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
51	4·86°	970·39	12725·02	4·81°	53—54	2·001151	1·991687	1·004752	
52	4·82	633·82	19399·54	"					
53	4·85	969·58	12732·16	"	50—52	3·064280	3·037153	"	1·008930
54	4·78	1940·27	6392·65	"	52—54	3·061230	3·034664	"	1·008755
55	4·70	1939.91	9336·41	4·70	55—56	1·999610	1·986962	1·006366	
56	4·62	970·13	18551·09	"					
57	4·65	1940·49	9332·82	"	57—58	2·000060	1·987867	1·006132	
58	4·60	970·22	18552·41	"					
59	4·62	971·56	18532·90	"	59—60	1·997718	1·985784	1·006010	
60	4·58	1940·91	9332·79	"	60—61	2·000198	1·987585	1·006346	
61	4·76	970·36	18549·71	"					
62	4·76	970·36	18548·98	"					
63	4·61	1945·33	11472·00	4·61	63—64	1·838150	1·827878		1·005619
64	4·55	1058·31	20969·42	"	64—65	1·837653	1·827378		1·005622
65	4·58	1944·80	11475·14	"	65—66	1·853518	1·842642		1·005902
66	4·61	1049·25	21144·57	"					

TABLE II.—*Compressibility of Nitrogen Gas.*

1	5·09	969·65	1506·24	5·09	1— 2	1·999794	1·997771	1·001012	
2	5·09	1939·10	753·96	"	2— 3	1·999434	1·996206	1·001617	
3	5·10	969·82	1505·06	"	3— 4	1·999506	1·997531	1·000988	
4	5·09	1939·17	753·46	"	4— 5	1·999506	1·998208	1·000650	
5	5·10	969·82	1505·57	"	5— 6	1·999359	1·997784	1·000788	
6	5·12	1939·03	753·62	"					
7	5·06	1939·53	1159·26	5·08	7— 8	1·999806	1·997817	1·000996	
8	5·08	969·86	2315·99	"	8— 9	1·999670	1·997524	1·001074	
9	5·09	1939·40	1159·43	"	10—11	1·998660	1·996507	1·001068	
10	5·08	970·35	2314·79	"	11—12	2·001061	1·999034	1·001014	
11	5·09	1939·40	1159·42	"					
12	5·07	969·18	2317·72	"					
13	5·11	969·90	4311·97	5·14	13—14	1·999065	1·996874	1·001097	
14	5·18	1938·89	2159·36	"	14—15	1·999433	1·997537	1·000966	
15	5·18	969·72	4313·33	"	15—16	2·000041	1·997282	1·001381	
16	5·18	1938·48	2159·60	"	16—17	2·000037	1·997398	1·001321	
17	5·14	969·72	4313·58	"	17—18	2·000330	1·997842	1·001245	
18	5·14	1939·76	2159·12	"					
19	5·03	970·25	6058·79	5·10	19—20	2·003354	1·999454	1·001950	
20	5·08	1943·75	3030·22	"	20—21	2·004084	2·000175	1·001955	
21	5·09	969·89	6060·97	"	21—22	1·998978	1·995309	1·001840	
22	5·10	1938·80	3037·61	"	22—23	1·998767	1·994910	1·001936	
23	5·14	970·00	6059·73	"					
24	4·95	970·14	7799·55	5·01	24—25	1·999840	1·994744	1·002555	
25	4·97	1940·12	3910·05	"	25—26	2·000341	1·996120	1·002115	
26	4·98	969·90	7804·93	"	28—29	1·999981	1·994923	1·002536	
27	5·02	577·19	13070·53	"	29—30	1·999691	1·994948	1·002377	
28	5·03	969·93	7798·91	"	32—33	2·000169	1·994954	1·002664	
29	5·01	1939·84	3909·38	"					
30	5·01	970·07	7799·02	"	25—27	3·361320	3·342803		1·005541
31	5·08	594·21	12700·20	"	27—29	3·360834	3·343377		1·005222
32	5·16	969·66	7800·12	"	29—31	3·264570	3·248648		1·004901
33	5·07	1939·48	3910·12	"	31—33	3·263970	3·248033		1·004907
34	4·96	970·49	9873·23	4·96	34—35	1·998897	1·993013	1·002952	
35	4·96	1939·91	4953·92	"	35—36	1·999762	1·994059	1·002860	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (*t*)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. *t'*	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
36	4·96°	970·07	9878·41	4·96°	38—39	1·999907	1·994263	1·002830	
37	4·97	604·35	15811·66	"	39—40	2·000049	1·994502	1·002781	
38	4·97	969·93	9879·56	"	42—43	2·000486	1·994961	1·002769	
39	4·98	1939·77	4953·99	"					
40	4·96	969·86	9880·74	"	35—37	3·209911	3·191748	"	1·005691
41	4·98	602·13	15870·52	"	37—39	3·209676	3·191703	"	1·005630
42	5·00	969·65	9882·40	"	39—41	3·221510	3·203583	"	1·005596
43	4·98	1939·77	4953·68	"	41—43	3·221500	3·203784	"	1·005533
44	4·93	970·03	11875·10	4·86	44—45	1·999987	1·993149	1·003431	
45	4·85	1940·05	5957·96	"	45—46	2·000196	1·993675	1·003271	
46	4·86	969·93	11878·24	"	48—49	2·000636	1·993104	1·003779	
47	4·81	606·31	18941·11	"	49—50	2·000341	1·993935	1·003213	
48	4·92	969·72	11875·73	"	52—53	2·000560	1·993619	1·003481	
49	4·85	1940·05	5958·41	"					
50	4·86	969·86	11880·68	"	45—47	3·199767	3·179127	"	1·006493
51	4·86	603·42	19027·80	"	47—49	3·199767	3·178886	"	1·006569
52	4·88	969·72	11881·79	"	49—51	3·215091	3·193435	"	1·006782
53	4·85	1939·98	5959·92	"	51—53	3·215975	3·192631	"	1·006999
54	4·98	1940·51	7294·47	4·96	54—55	2·000237	1·992725	1·003770	
55	4·98	970·14	14535·87	"	57—58	2·000959	1·993935	1·003523	
56	4·96	690·78	20351·90	"	60—61	1·999910	1·991768	1·004088	
57	4·96	1940·65	7293·84	"	61—62	1·999978	1·992084	1·003963	
58	4·96	969·86	14543·44	"					
59	4·95	685·74	20493·29	"	54—56	2·809154	2·790046	"	1·006849
60	4·90	970·07	14534·63	"	56—57	2·809360	2·790286	"	1·006836
61	4·94	1940·05	7297·35	"	57—59	2·830010	2·809670	"	1·007239
62	4·93	970·03	14536·93	"	59—61	2·829136	2·808318	"	1·007413
63	5·20	1939·91	7297·06	5·20	63—64	2·000196	1·992373	1·003924	
64	5·20	969·86	14538·50	"	66—67	2·000495	1·992180	1·004174	
65	5·17	689·04	20394·93	"	67—68	2·000568	1·992570	1·004014	
66	5·21	969·82	14537·09	"	70—71	2·001170	1·993065	1·004287	
67	5·21	1940·13	7297·08	"					
68	5·22	969·79	14539·94	"	63—65	2·815380	2·794951	"	1·007309
69	5·25	687·03	20447·42	"	65—67	2·815700	2·794944	"	1·007426
70	5·27	969·61	14538·85	"	67—69	2·823939	2·802137	"	1·007779
71	5·22	1940·36	7296·32	"	69—71	2·824270	2·802429	"	1·007793
72	5·07	1941·81	8628·54	5·13	72—73	2·008706	1·999174	1·004768	
73	5·08	966·70	17249·95	"	75—76	2·007120	1·997684	1·004723	
74	5·09	801·34	20789·40	"	76—77	2·007408	1·998213	1·004602	
75	5·15	966·59	17250·20	"	79—80	2·007302	1·998280	1·004515	
76	5·13	1940·06	8635·18	"					
77	5·13	966·45	17254·93	"	72—74	2·423203	2·409377	"	1·005739
78	5·18	799·66	20827·79	"	74—76	2·421020	2·407546	"	1·005596
79	5·18	966·69	17250·54	"	76—78	2·426106	2·411969	"	1·005861
80	6·18	1940·44	8632·69	"	78—80	2·426585	2·412665	"	1·005769
81	4·90	1942·04	9767·42	4·93	81—82	2·001963	1·991712	1·005147	
82	4·87	970·07	19453·89	"	82—83	1·999845	1·990576	1·004657	
83	4·94	1939·99	9772·99	"	83—84	1·999869	1·989973	1·004822	
84	4·90	970·10	19447·99	"	84—85	1·999907	1·989894	1·005032	
85	4·90	1940·12	9773·38	"	85—86	1·999549	1·990418	1·004588	
86	4·93	970·28	19453·12	"	86—27	1·999725	1·990011	1·004881	
87	4·98	1940·29	9775·38	"					
88	4·09	1942·84	10981·42	4·09	88—89	1·931636	1·919244	"	1·006456

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
89	4·10°	1005·80	21076·03	4·09°	89—90	1·931488	1·919378	"	1·006309
90	4·09	1942·69	10980·66	"	90—91	1·935760	1·923338	"	1·006458
91	4·09	1003·58	21119·52	"	91—92	1·936140	1·924005	"	1·006307
92	4·08	1943·07	10976·85	"	92—93	1.937781	1·925166	"	1·006552
93	4·12	1002·73	21132·28	"	93—94	1·935115	1·924931	"	1·006784
94	4·08	1943·28	10978·20	"					

TABLE III.—*Compressibility of Carbonic Acid Gas.*

1	3·28	969·89	1516·00	3·28	1— 2	1·999289	1·984225	1·007597	
2	3·28	1939·10	764·03	"					
3	3·29	969·25	1518·42	"	3— 4	2·001740	1·986395	1·007725	
4	3·23	1940·19	764·41	"					
5	3·28	969·72	1516·62	"	5— 6	2·000630	1·985469	1·007636	
6	3·27	1940·05	763·86	"					
7	3·26	1939·68	765·77	3·27	7— 8	1·998515	1·981835	1·008416	
8	3·25	970·56	1517·63	"					
9	3·27	1939·91	765·01	"	9—10	1·998732	1·983268	1·007797	
10	3·27	970·57	1517·22	"	10—11	1·997897	1·982231	1·007903	
11	3·28	1939·10	765·41	"					
12	3·29	969·96	2789·17	3.31	12—13	1·995740	1.971465	1·012313	
13	3·29	1935·61	1414·77	"					
14	3·29	969·93	2788·84	"					
15	3·33	1939·70	1412·94	"	15—16	1·999835	1·974288	1·012940	
16	3·33	969·93	2789·55	"					
17	3·30	1939·91	1413·46	"					
18	3·31	970·28	2788·79	"	17—18	1·999331	1·973024	1·013333	
19	3·32	1939·84	1412·70	"	18—19	1·999256	1·974085	1·012751	
20	3·43	970·18	4246·71	3·32	20—21	1·998921	1·961701	1·018973	
21	3·31	1939·31	2164·81	"					
22	3·32	969·79	4247·28	"	22—23	1·999732	1·962418	1·019014	
23	3·32	1939·32	2164·31	"					
24	3·32	969·86	4247·41	"	24—25	2·000188	1·962043	1·019442	
25	3·30	1939·90	2164·79	"					
26	3·26	969·86	4247·23	"	26—27	2·000630	1·962431	1·019465	
27	3·26	1940·33	2164·27	"					
28	3·56	970·18	6202·71	3·65	28—29	2·002654	1·946785	1·028698	
29	3·62	1942·93	3186·13	"	29—30	2·003238	1·947739	1·028494	
30	3·62	969·90	6205·75	"	32—33	2·004862	1·948327	1·029017	
31	3·65	493·91	11526·98	"	33—34	2·003833	1·948274	1·028517	
32	3·65	969·86	6203·61		36—37	2·003392	1·947530	1·028684	
33	3·69	1944·44	3184·07	"					
34	3·69	970·36	6203·44	"	29—31	3·933780	3·617862	"	1·087322
35	3·71	518·42	11045·25	"	31—33	3·936821	3·620202	"	1·087460
36	3·74	969·47	6208·12	"	33—35	3·750696	3·468910	"	1·081232
37	3·74	1942·23	3187·69	"	35—37	3·746442	3·464971	"	1·081232
38	3·56	970·00	7357·51	3·56	38—39	2·000127	1·932414	1·035040	
39	3·54	1940·12	3807·42	"	39—40	1·999982	1·932792	1·034763	
40	3·56	970·07	7358·95	"	42—43	2·000124	1·932620	1·034929	
41	3·56	612·93	11193·20	"	43—44	2·000268	1·933363	1·034606	
42	3·56	969·86	7358·69	"	46—47	1·999907	1·932720	1·034763	
43	3·56	1939·84	3807·61	"					

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. ρ	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
44	3·56°	969·79	7361·49	3.56°	39—41	3·165324	3·018577	"	1·076700
45	3·56	612·32	11198·95	"	41—43	3·164864	3·018427	"	1·076597
46	3·56	970·00	7358·21	"	43—45	3·168016	2·941201	"	1·077116
47	3·56	1939·91	3807·18	"	46—47	3·168130	2·941533	"	1·077034
48	3·21	1939·10	4879·77	3·20	48—49	1·999577	1·912328	1·045625	
49	3·21	969·75	9331·72	"	51—52	2·001917	1·914310	1·045760	
50	3·20	594·32	14376·80	"	52—53	2·001876	1·914792	1·045070	
51	3·20	969·36	9333·18	"	55—56	2·000415	1·913018	1·045685	
52	3·20	1940·57	4875·48	"					
53	3·20	969·86	9334·54	"	48—50	3·262720	2·946205	"	1·107431
54	3·20	589·46	14478·45	"	50—52	3·265198	2·948797	"	1·107296
55	3·26	969·65	9329·77	"	52—54	3·292118	2·969640	"	1·108590
56	3·23	1939·70	4876·99	"	54—56	3·290633	2·968720	"	1·108435
57	3·16	1939·25	6820·22	3·16	57—58	1·999660	1·875613	1·066137	
58	3·16	969·79	12792·09	"	60—61	1·999433	1·875463	1·066101	
59	3·16	553·34	20284·08	"					
60	3·16	969·86	12790·74	"	57—59	3·504624	2·976850	"	1·177293
61	3·16	1939·17	6820·07	"	59—61	3·504481	2·976916	"	1·177220
62	3·15	1939·91	8393·68	3·15	62—63	2·001516	1·845943	1·084278	
63	3·15	969·22	15493·00	"	65—66	2·000197	1·844043	1·084680	
64	3·14	670·62	20766·50	"	66—67	2·000940	1·844647	1·084672	
65	3·15	969·86	15481·24	"	69—70	1·997970	1·842618	1·084310	
66	3·14	1939·91	8395·27	"					
67	3·15	969·50	15487·01	"	62—64	2·892713	2·474063	"	1·169215
68	3·15	675·87	20648·15	"	64—66	2·892713	2·473596	"	1·169437
69	3·15	970·57	15470·37	"	66—68	2·870242	2·459500	"	1·167003
70	3·15	1939·17	8395·86	"	68—70	2·869147	2·459325	"	1·166640
71	2·66	1935·25	9620·06	2·68	71—72	1·994456	1·813421	1·099830	
72	2·67	970·31	17445·23	"	74—75	1·995546	1·814813	1·099588	
73	2·67	774·75	20791·02	"	76—77	1·995978	1·814671	1·099912	
74	2·68	969·86	17452·18	"	79—80	1·996453	1·815851	1·099459	
75	2·68	1935·40	9619·52	"					
76	2·68	1935·40	9619·97	"	71—73	2·497903	2·161214	"	1·155787
77	2·68	969·65	17457·08	"	73—76	2·498096	2·161235	"	1·155865
78	2·69	779·67	20689·05	"	76—78	2·482332	2·150635	"	1·154232
79	2·70	969·72	17453·67	"	78—80	2·483100	2·152331	"	1·153681
80	2·70	1936·00	9612·39	"					

TABLE IV.—*Compressibility of Hydrogen Gas.*

1	4·40	969·19	4431·14	4·41	1— 2	2·001134	2·003971	0·998584	
2	4·41	1939·47	2211·18	"	5— 6	2·003048	2·004305	0·999373	
3	4·43	969·78	4428·19	"					
4	4·43	402·30	10715·19	"					
5	4·41	968·37	4432·90	"	2— 4	4·820120	4·845916	"	0·994676
6	4·40	1939·69	2211·69	"	4— 6	4·820666	4·844798	"	0·995020
7	4·22	969·86	7999·09	4·22	7— 8	2·000196	2·005051	0·997578	
8	4·22	1939·91	3989·47	"	8— 9	2·000484	2·006582	0·996961	
9	4·22	969·72	8005·20	"					
10	4·23	563·34	13832·05	"	8—10	3·443585	3·467140	"	0·993206
11	4·23	389·95	20110·99	"	8—12	3·433287	3·455545	"	0·993559
12	4·23	565·03	13785·79	"	8—11	4·974765	5·041017	"	0·986857

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. ρ	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
13	4·38°	1939·17	3992·10	4·22°					
14	4·38	970·57	7998·82	"	13—14	1·997970	2·003662	0·997159	
15	3·92	1939·54	5845·18	3·92	15—16	1·999381	2·007166	0·996121	
16	3·92	970·07	11732·25	"	16—18	2·000380	2·008764	0·995826	
17	3·97	601·60	19002·88	"	19—20	2·001310	2·009197	0·996074	
18	3·94	1940·51	5840·53	"	22—23	1·999896	2·007781	0·996073	
19	4·19	1940·57	5847·16	4·19					
20	4·19	969·65	11748·10	"	15—17	3·225580	3·250862	"	0·991433
21	4·19	566·09	20254·36	"	17—18	3·223970	3·253450	"	0·991727
22	4·18	969·89	11744·76	"	19—21	3·426470	3·463965	"	0·989592
23	4·19	1939·69	5849·62	"	21—23	3·428024	3·462508	"	0·989624
24	3·87	1939·84	9176·50	3·86	24—25	2·000709	2·014948	0·992933	
25	3·74	969·58	18490·17	"	27—28	2·001034	2·014534	0·993297	
26	3·86	858·36	20904·89	"	24—27	2·000865	2·014162	0·993349	
27	3·86	969·50	18483·88	"	28—29	2·000652	2·014500	0·993126	
28	3·94	1940·00	9175·25	"	31—32	2·001746	2·014602	0·993618	
29	3·87	969·69	18483·54	"	33—36	2·000340	2·013762	0·993335	
30	3·94	862·16	20807·95	"					
31	3·89	969·18	18485·42	"	24—26	2·259936	2·278090	"	0·992031
32	3·87	1940·06	9175·72	"	26—28	2·260127	2·278400	"	0·991980
33	3·86	969·79	18478·94	"	28—30	2·250230	2·267834	"	0·992290
34	3·86	854·94	20985·19	"	30—32	2·250165	2·267718	"	0·992209
35	3·86	969·93	18473·33	"	32—34	2·269060	2·287034	"	0·992207
36	3·86	1939·91	9176·33	"	34—36	2·269234	2·286883	"	0·992217

TABLE V.—*Compressibility of Hydrogen Gas.*

1	10·02	968·97	11165·36	10·00	1— 2	2·002025	2·009850	0·996107	
2	10·00	1939·91	5555·32	"	2— 3	2·002314	2·010480	0·995938	
3	10·02	968·83	11168·86	"	5— 6	2·001516	2·009609	0·995973	
4	10·01	559·19	19463·09	"	6— 7	2·000557	2·008684	0·995954	
5	10·01	969·22	11161·57	"	9—10	2·001092	2·009453	0·995839	
6	10·01	1939·91	5554·10	"					
7	10·02	969·68	11156·43	"	2— 4	3·469142	3·503505	"	0·989974
8	10·01	559·34	19459·74	"	4— 6	3·469142	3·504274	"	0·990192
9	10·02	969·61	11160·04	"	2— 8	3·468212	3·502902	"	0·989880
10	10·03	1940·29	5553·77	"	6— 8	3·468212	3·503671	"	0·990097
11	9·62	1939·98	7074·96	9·62	11—12	2·000412	2·011075	0·994697	
12	9·62	969·79	14228·28	"	12—13	2·001103	2·011974	0·994597	
13	9·61	1940·65	7071·80	"	13—14	2·001557	2·012350	0·994636	
14	9·62	969·57	14230·94	"	14—15	2·001401	2·011770	0·994846	
15	9·62	1940·50	7073·84	"	15—16	2·000804	2·011390	0·994737	
16	9·62	969·86	14228·25	"	16—17	2·000959	2·011765	0·994628	
17	9·62	1940·65	7072·52	"					
18	9·66	1940·86	9147·61	9·69	18—19	2·000168	2·013745	0·993258	
19	9·69	970·35	18420·96	"	19—20	1·999939	2·013624	0·993203	
20	9·68	1940·64	9148·16	"	20—21	2·001094	2·014892	0·993152	
21	9·69	969·79	18432·55	"	21—22	2·001167	2·014711	0·993277	
22	9·67	1940·71	9148·98	"	22—23	2·001167	2·014649	0·993308	
23	9·69	969·79	18431·93	"					
24	9·73	1939·34	10361·88	9·65	24—25	1·999540	2·015000	0·992327	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t°	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
25	9·66°	969·89	20879·18	9·65°	25—26	2·001043	2·016423	0·992373	
26	9·64	1940·80	10354·59	"	26—27	1·999650	2·015158	0·992304	
27	9·65	970·57	20866·14	"	27—28	1·999568	2·014913	0·992384	
28	9·64	1940·72	10355·85	"	28—29	2·000745	2·015827	0·992518	
29	9·67	970·00	20875·60	"	29—30	1·999909	2·015050	0·992485	
30	9·65	1939·91	10359·84	"					
31	9·65	1940·62	11158·81	"	31—32	1·880682	1·893271	"	0·993297
32	9·66	1031·87	21127·77	"	32—33	1·880226	1·893033	"	0·993235
33	9·64	1940·15	11160·80	"	33—34	1·882690	1·895529	"	0·993227
34	9·65	1030·52	21155·62	"	34—35	1·882622	1·895257	"	0·993333
35	9·65	1940·08	11162·40	"	35—36	1·885289	1·898066	"	0·993271
36	9·65	1029·06	21186·97	"	36—37	1·885820	1·899051	"	0·993032
37	9·65	1940·62	11156·61	"					
38	9·00	1941·45	11126·62	9·03	38—39	1·833840	1·845004	"	0·993949
39	9·03	1058·68	20528·67	"	39—40	1·832564	1·844123	"	0·993732
40	9·03	1940·10	11131·94	"					
41	8·94	1940·60	12512·92	8·95	42—43	1·636558	1·645227	"	0·994730
42	8·95	1185·80	20576·78	"	43—44	1·637772	1·646029	"	0·994984
43	8·95	1940·63	12513·03	"	44—45	1·637773	1·645807	"	0·995118
44	8·95	1184·92	20596·80	"	45—46	1·639900	1·649134	"	0·994401
45	8·95	1940·10	12514·71	"	46—47	1·640153	1·649291	"	0·994460
46	8·94	1183·06	20638·43	"					
47	8·95	1940·40	12513·51	"					

(To be Continued.)

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Paddle-Wheels.

The following thoughts on paddle-wheels are respectfully submitted: As I have not kept the run of recent propositions on the subject, it is possible that the view I have taken may be neither novel nor correct: if so, I can only claim the merit of having suggested what I thought *might* be both useful and new. But theory is one thing and practice another. The former is polite and complaisant; the latter, a sturdy, inflexible fellow, that no coaxing can soften. One will often accompany a votary in his wanderings, the other won't deviate a hair's-breadth if an inventor's salvation depended upon it.

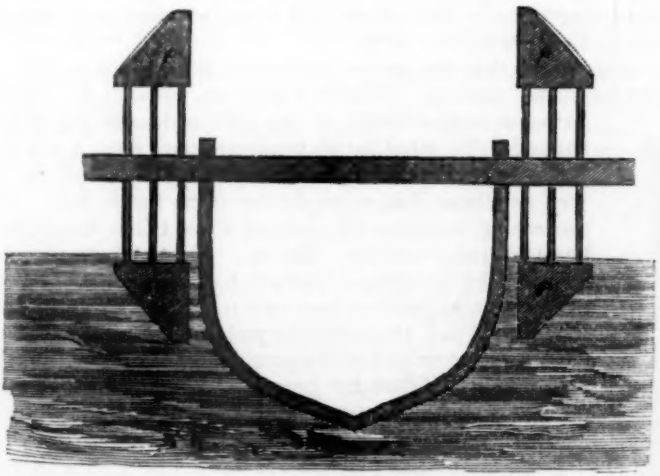
That any plan involving movements of paddles on their arms, with the view of feathering them, and more especially their suspension on pinions for that purpose, will never receive the sanction of modern engineers, I feel fully persuaded. Such wheels are too complex to be trusted, particularly on the ocean, while their auxiliary movements are all but incompatible with the requisite velocity of the chief one. Notwithstanding innumerable projects for improving or superseding it, the old paddle-wheel still holds its own, and like the oar, seems to deride all

attempts to beat it. In modern steamers it scarcely differs an iota from those used in Roman galleys, mediæval ferry-boats.

Paddles in use are rectangular blades, arranged parallel to the shafts to which they are attached, and around which they necessarily describe cylinders. They constitute cylindrical paddle-wheels. Their acknowledged defects are chiefly two. 1. When they strike the water their tendency is rather to depress it than to cast it behind them, which in fact they cannot do, till, in their progress downwards, they are passing or about to pass under their axes; hence a portion of the power that drives them is wasted on indirect action. 2. So also when rising to the surface, they lift the fluid, produce what is called backwater, and thereby uselessly expend another portion of the motive treasure. Viewed in connexion with a boat at rest, these are serious drawbacks. To a certain extent they are diminished with her speed; still they are drawbacks, and, unfortunately, are inseparable from fixed blades revolving in circles round their axes.

The question then is: Can anything be done to make *fixed* paddles more efficient by *lessening* the water's resistance to them at those parts of their stroke or sweep, when their propelling property is weakest, and without adding to it when that property is greatest.

I submit that, in some degree, this desideratum may be realized by *conical* paddle-wheels. These may be made either by altering the figure of common paddles, or their position on the arms, viz: by inclining them to their shafts. Of obvious modifications of such wheels, one will be sufficient for an illustration.



Paddles shaped like *p p*, instead of uselessly striking the surface of the water with their entire length, dip first their pointed extremities, and when half their depth is immersed the larger part of their faces will be still without, contrary to rectangular ones, whose immersed areas increase *pari passu* with their dip. Here, the most powerful part of the blade is withheld from the water till it can be brought into

play with the best effect; the largest amount of propelling surface being introduced when it is most wanted, and not before. Like the feathering of oars and paddles, the surface is virtually diminished when its presence is injurious, and enlarged when it is most desirable.

But some will perhaps say, True, the blade dips with its point, but its base is the first to emerge, and consequently encounters a resistance equal to that evaded on entering. Not at all. It would be really so, if that base were as far out from the shaft as the point or apex, not otherwise. The resistance to a blade on leaving the water is greatest at its extremity, and increases of course with the width at that extremity. The outer edges might probably be slightly curved with advantage, so as to make each paddle a portion of an ellipse, as shown by dotted lines at p' p'.

I may be mistaken, but I think such paddles will be found preferable to ordinary shaped ones of equal surface. Besides being generally more efficient, they will cause less jar or tremor on striking the water; the shaft virtually will be strengthened, by withdrawing the strain from its outer ends—its weakest parts—to where it is stronger, and the work will be brought nearer to the power. When a cylindrical wheel is submerged by a vessel lurching, the strain on the submerged end of the shaft is extreme; but this can never happen to conical wheels, because of the reduced surface of the outer ends of the paddles.

To determine the best form of paddles—to ascertain whether it is better to extend them abroad from the sides of a vessel, or give them a greater dip and keep them nearer home—and, lastly, to find the limits outwards and downwards which yield the highest results—are problems interesting in themselves, and whose solution is of increasing importance to the world at large.

It is remarkable that the parent instrument, the Indian paddle, is invariably long and pointed. Find it where we will—in the hands of savages, semi-tutored, or the civilized—the end is spear-shaped. To what is this uniform result due, if not to experience? How is it that human sagacity in all times, as well as climes, has wrought the same figure out? If not possessing superior advantages, some tribes would surely have adopted another. But no. Everywhere man, as if impelled by a common instinct, has selected it. From its perpendicular position and action, it gave its name to our wheels. They are revolving paddles. Speed has always been a prime object in the propulsion of canoes. Is there any essential difference between them and steamers, to require a different form and proportions in propelling blades?

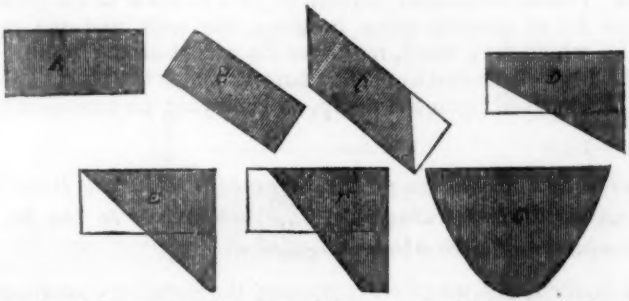
Long triangular paddles are figured on Etruscan vases; Isosceletic blades, blunted and truncated, may be seen on classic sculptures.

The figure is a South Sea paddle in my possession. It resembles several in Montfaucon. Charon is often represented with one akin to it.

By increasing the dip of paddles, the circles they describe are en-

larged, but in conical wheels that enlargement is confined to one side, while the width of the wheel and length of the shaft would be proportionably diminished. Such wheels could never be wholly raised out of the water by a vessel rolling. In the heaviest seas, they would have more or less hold of it.

Taking A for the position and proportions of a common paddle, what would be its comparative value if placed as at B; and when changed in its form, as at C, D, E, and F; and when doubled and the edges curved as F at G?



Where speed is everything, especially in vessels varying from 200 to 300 feet in length, instead of enlarging the present mammoth wheels, cannot a pair, if not more, of moderate sized ones be used to advantage at each side, as well as rows of oars in boats, and paddles in canoes? E.

A Simplified Form of the Mechanical Lamp. By M. Careau.

The lamp of French invention, in which the oil is raised to the wick by means of machinery, is well known in this country, under the names of "the Mechanical Lamp," "the Carcel Lamp," "the Diacon Lamp;" and to those who have used it, or seen it used, we need hardly say, that for brilliancy and steadiness of light, it has never yet been equalled. The greatest objection to it is its expensiveness, the plainest lamp costing (in this city) about $15.

M. Careau of Paris has already made several improvements, which have been favorably reported on to the Society for the Encouragement of National Industry—and from their Bulletin for October 1847, we copy the accompanying plate and description of his last simplifications, by which the price in Paris is reduced to 15 francs. ($3.)

We feel confident that if any of our ingenious Eastern friends were to take the trouble to get up patterns for a lamp of this kind, they would deserve the thanks of oil burners, and be enabled to furnish at a moderate price, a lamp, superior even to the excellent ones which we have now.

Description of the Figures. Plate III.

Fig. 4. Front elevation of the mechanism.

Fig. 5. Plan of the same. The same letter refers to the same part in both figures.

A. A plate forming one of the sides of the oil-box, to which is attached the pump B, of tin, composed of two parts, one placed on the other. Each of these parts is cast in one piece, and they are attached together by a screw at each corner.

C. The barrel whose teeth take into those of a pinion D, upon the shaft E.

G G. The eccentrics upon the shaft E; a part of the circumference is embraced by the forks H H, which form part of the levers I I, whose fulcrums are in the pillars J J.

K K. Piston rods—four in number, two to draw in the oil, and two to raise it; an annular space between the rods, and the openings through which they work, regulates the ascent of the liquid.

L L. Projections cast upon the pump, in which the valves are placed.

M. Plate fixed upon the pump, and carrying the ascension tube N.

Report on the Explosion of the Steamboat Edward Bates on the Mississippi River, August 12th, 1848, made to the St. Louis Association of Steamboat Engineers.

The undersigned, members composing the Standing Committee of the St. Louis Association of Steamboat Engineers, respectfully report, that in the discharge of the duties assigned them by the provisions of the sixteenth article of the Constitution of said Association, they went on board of the steamboat *Edward Bates*, on the 15th instant, for the purpose of examining into the cause of the recent catastrophe on board of said boat, and unanimously report the following as the result of said examination:

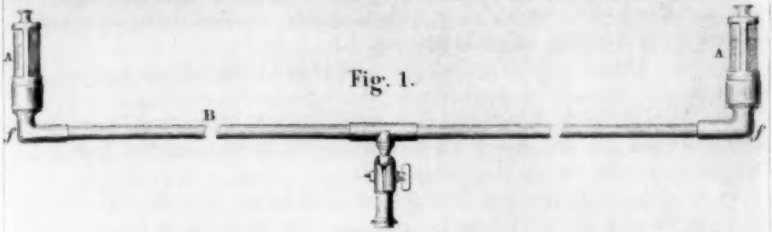
The *Edward Bates* has three double flue boilers, thirty feet in length, and forty-two inches in diameter; flues, sixteen inches in diameter, all made of iron one-fourth of an inch in thickness, and have been in use only since the first of March last. The iron is of a good quality, and the workmanship unquestionable.

The diameter of the safety valve is found to be three and eleven-sixteenth inches; the weight of the valve and lever is one hundred and thirty-two pounds; the pea hanging on the lever weighs one hundred and nine pounds, and was found attached to the lever at the distance of thirteen spaces or leverages, from the safety valve; and that the extra lead weight and wrenches attached to the safety-valve line, at the time of the catastrophe, weighed forty-two pounds, and were sixteen spaces or leverages from the safety-valve.

From the above data, it is ascertained that the weight on the safety valve was equal to a pressure of two hundred and six pounds to the square inch, without calculating the friction of the pulleys over which the line attached to the safety-valve was passed.

The Committee have been politely furnished with the written statements of Capt. Johnson, Wm. S. Belt, Clerk, I. C. Sitton, Pilot, and George G. Ambrose, Assistant Engineer, and also with the written statements of James W. Booth and Wm. Myers, passengers, the latter

Fig. 1.



Scale for Fig. 1. Décimètres

Fig. 5.

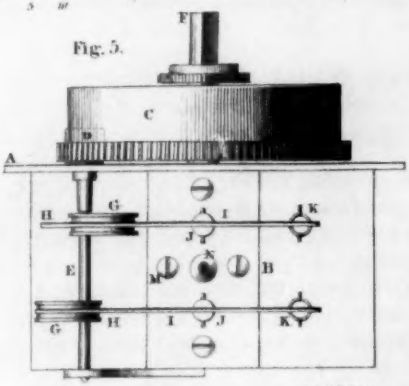


Fig. 2.

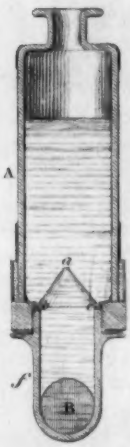
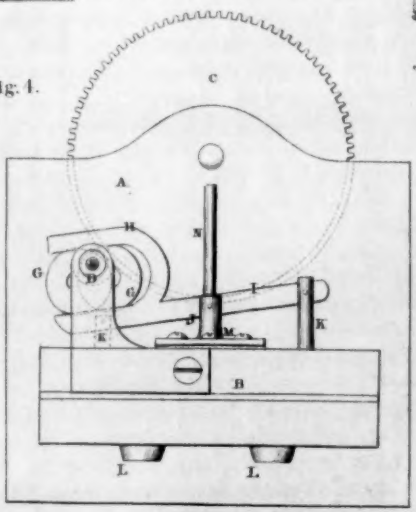
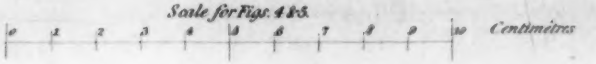


Fig. 3.

Fig. 4.



Scale for Figs. 4 & 5.



an engineer—all of whom were on board of the boat at the time of the catastrophe—copies of which are appended to this report.

From the above named statements it appears, that about 4 o'clock in the morning of Saturday, the 12th inst., when at the head of Westport shute, a short distance below Hamburg, both flues of the larboard boiler collapsed immediately. James Donahoe, chief engineer, and George C. Ambrose, assistant, being on duty at the time. That at the time of the explosion the fires were full; the fire doors and flue caps closed; the doctor and pumps stopped, and a weight on the safety valve equal to a pressure of two hundred and six pounds to the square inch.

It also appears that, for the last nine miles, the two engines had been worked slow and fast alternately; that steam had been blowing off occasionally while running slow; that the Engineer told the firemen to shove up the fires, and that the safety-valve was shut down twice within a few minutes previous to the explosion, and that "*the last time he shut it down the accident happened*," to use the language of the assistant.

From a particular examination of the flues, after the collapse, it appears that the rivets, where the sides have been forced together, in several places, have made indentations plainly discernible on the outsides of the flues, from which fact, as well as from the peculiar shapes into which the flues are warped and twisted, it is plainly indicated that a portion of the flues were red hot at the time of the explosion.

From all these circumstances, the undersigned have come to the conclusion unanimously that the disaster was caused by the water being too low in the boiler, and by the unusual head of steam accumulated by overloading the safety valve, increasing the fires, and shutting off the supply of water from the pumps; and *that these causes are to be attributed to the recklessness, or imprudent management of the Chief Engineer on duty, James Donahoe.*

While the committee consider it their sacred duty to shield from unjust censure any member of the Association, yet it is equally their duty to bestow censure where it properly belongs. This duty they owe to themselves individually, to the Association which has made them its agents, and to the community of which they form a part. This is the first occasion since the organization of this Association in 1842, that any serious disaster has occurred to any boilers in the charge of any of our members, and the circumstances are such as demand of the Association their most serious attention, and call for the adoption, in this case, of such measures as will effectually carry out the objects of the Association, and prevent the future occurrence of similar catastrophes.

In concluding this report, it may be proper to state that the portion of the statement of George G. Ambrose, in relation to the *fire doors or flue caps being open all the time while running through the shute*, was given as his belief or impression—but when questioned as to the means by which he obtained such belief or impression, it was ascertained that he had no means of knowing whether they were open or shut.

The time that elapsed between the moment the doctor was stopped and the explosion, is stated by the only witness who was aware of the fact, to be about one minute. This may be true, and if so it only goes to prove that the best boilers cannot be trusted even that short period of time without a proper supply of water to keep the flues covered, and preserve them from the action of the fires beneath.

If the boat was "in the habit of rolling very much," as represented by the assistant engineer, then it would have been the duty of an engineer to have closely watched the water in the outer boilers, and if he found it scant, he should not have had such heavy fires as were evidently under these boilers at the time of the collapse.

The pilot and assistant engineer express the opinion that the boat was trim at the time of the explosion, but the position of the flues as found by your committee does not corroborate this statement. The committee found the collapsed flues lying in an oblique position, with their tops leaning to the larboard side, and their bottoms to the starboard side of the boiler, thus clearly indicating by their position, in the minds of your committee, that the boat was careened to the starboard when the explosion took place.

This Association has repeatedly asked of Congress the passage of a law restricting engineers to the amount of pressure that should be carried on boilers on board of steamboats, but have thus far failed to effect so desirable an object. Had a law of this kind been passed, with proper and adequate penalties, the design of the Association could have been fully carried out, and thereby have amply secured to those traveling on our western waters, their lives and property. The committee having discharged the duty assigned to them, by an investigation of the facts presented to them, leave the matter to the final disposition of the Association, with the firm assurance that they will do all that the moral force of their action can effect in the premises.

Very respectfully,

JAMES H. MCCORD,
PETER VANDERVORT,
ANDREW BOSWELL,
A. S. HALSTEAD,
WM. W. DENSON.

ST. LOUIS, Aug. 17, 1848.

Statement of W. C. Johnson, Commander of Steamboat Edward Bates, Aug. 14, 1848.

The boat landed at Cap au Gris about two o'clock on the morning of the 12th Aug., and discharged about two tons of freight. Having no landings to make before we reached Hamburgh, a distance of twenty miles, I retired, leaving the first engineer, pilot, and watchman on duty. Up to this time, from every appearance, she carried no more than the usual quantity of steam. At four o'clock, I was awakened by the explosion or the cry of fire. On going below, I found that the flues of the larboard boiler had collapsed, fore and aft. Any information of the facts with regard to the explosion which I may have, are from the officers on watch and the passengers who were up

at the time. The accident occurred at the head of Westport shute. The boat had been running over shoal water for nine or ten miles previously.

Statement of W. S. Belt, Clerk.

I was awake for some time previous to the accident and thought there was an unusually loud escapement of steam from the safety valve, although I did not think of danger at the time. The escapement of steam, from the noise made, seemed to increase every moment, till the collapse took place. As to the gauge cocks being tried, I could not say, as it was impossible from the noise made by escapement of steam immediately under me, to hear it, as it drowned all other noise on the boat to my hearing.

Statement of Wm. Myers, Passenger.

I was in bed at the time of the explosion, which wakened me very suddenly; got up and went below as quickly as possible; discovered the blaze from the fires standing out between the boilers; fires were full of wood at this time; fire doors and flue caps that were remaining all shut up: began to throw water on the fires, and continued at that until the blaze was stopped from between the boilers, and then went to safety valve lines, and found the lead weight hanging on the valve lines, and believe that there were two wrenches lying there likewise.

Statement of Isaac C. Sitton, Pilot.

Came on watch at 12 o'clock, as also did Mr. J. Donahoe, first engineer. In going through Westport shute, we worked both engines, slow and fast alternately, which was a distance of nine miles; she was blowing off occasionally while running slow; heard the water tried and it sounded as though it was flush; don't know upon which side, or whether more than one gauge cock was tried or not. I think she was trim when the explosion took place; do not think that there was any more steam carried this trip than on any previous trip; in running the last quarter of a mile I heard the engineer shut the valve down twice, and still kept blowing off until the explosion took place. Some few minutes before the explosion took place, heard the engineer tell the fireman to shove up the fires.

Statement of Geo. G. Ambrose, Assistant Engineer.

I came on watch with Mr. Donahoe at 12 o'clock, some ten or twelve miles below Cap au Gris; we had no difficulty at all in keeping water in the boilers; when in Westport shute water in the boilers flush in the upper gauge cocks, and doctor running, and about an ordinary head of steam; the doctor was not stopped more than a minute; all the time in running through the shute the fire doors were open, and flue caps also; from the time she commenced working slow, steam was blowing off, which was a distance of eight or ten miles; Mr. Donahoe shut the safety valve two or three times, and the last time he shut it down the accident happened; at the time of the occurrence there was less weight on the valve lines than was usually carried;

tried the water and found it flush, and stopped the doctor, and did not try the water afterwards; it was not more than one minute from the time the doctor was stopped until the explosion took place; don't know exactly but think that Mr. Donahoe had hold of the safety valve lines at the time of the explosion; the boat was in the habit of rolling very much.

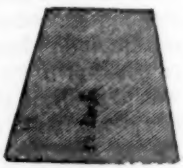
Statement of James M. Booth, Passenger.

Was up at the time of the explosion of the boilers of the steamer Edward Bates; thought the steam high at the time; the boat running slow at the time of making the crossing just below Hamburg, Ill., the explosion took place about 4 o'clock on the morning of the 12th, and heard the steam escaping; think I heard two gauge cocks tried once, or one tried twice; was of the impression the engineer was on duty and at his post; immediately after reaching the banister on the boiler deck, larboard side, the explosion occurred; am not a competent judge whether there was water enough in the boiler at the time the gauge cocks were tried or not. St. Louis Daily Union.

Statement of Experiments made on the Relative Strength of Cast Iron, Chilled and Unchilled, at Crane Foundry, on July 21, and August 23, 1847.

I. *Experiments of July 21.*

The bars upon which the experiments were made were two in number, and were run at the same time from the same pot of metal. One of the bars was cast in the ordinary method of green sand-casting, and of the following dimensions:—Width of top edge, ½ an inch; width of bottom edge, 1 inch; depth, 1½ inch; total length, 4 feet; width between the supports when proved, 3 feet 10 inches; area of cross section, 1·125 inch; weight, 13½ lbs.



The chilled bar had exactly similar dimensions to the above: except that the width of the bottom edge was $\frac{15}{16}$ths of an inch only, instead of 1 inch, this difference arising from the sudden cooling of the bottom edge, which was run upon a piece of cold iron in order to chill it; (the bottom edge being the only part chilled;) in consequence the area of the cross section was only 1·078, instead of 1·125, and the weight was 12 lbs. 13 oz., instead of 13½ lbs.

As the chilled and unchilled bars are of different areas, and consequently of different strengths, it will be necessary before comparing them, in order to find the results produced by chilling, to reduce the weights they are capable of bearing to the standard of one or other of their areas. It will be most convenient to reduce the area of the unchilled bar to that of the chilled bar: and since solid cast iron beams will carry nearly in proportion to their cross sections, every thing else being the same, the strength of an unchilled bar of the same area as the chilled bar, will be found as follows:—As the area of the large unchilled bar, 1·125 inch, is to the area of the smaller chilled bar, 1·078

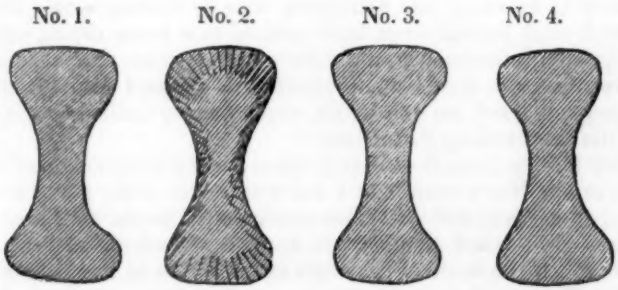
inch, so is 6·28 cwt., the weight borne by the large unchilled bar, to 6·01 cwt., the weight which would have been borne by an unchilled bar of the same area as the chilled bar. But by the process of chilling, the small bar was made capable of bearing a weight of cwt. 7 035, instead of cwt. 6·01, the weight it would have borne had it not been chilled; and in consequence it results, that the process of chilling the under edge of the bar gives a superior strength of 17 per cent. on the cross section.

Number of Experiments.	Load carried by the bar.			Deflection observed in decimal parts of an inch.		Chilled bar deflects more than unchilled by difference as under.	Remarks.
	cwt.	qr.	lbs.	Unchilled bar.	Chilled bar.		
1	. .	3	4	·0000	0000	·0000	
2	1	3	4	·0000	·0625	·0625	
3	2	3	4	·0625	·1250	·0625	All weights taken off, bars resumed their original position.
4	3	3	4	·1250	·2187	·0937	
5	4	3	4	·2500	·3125	·0625	
6	5	1	4	·2969	·3437	·0468	
7	5	3	4	·3125	·4060	·0935	
8	6	1	4	·3437	·4687	·1250	
9	6	2	4	Broke.	·5321		3 ins. from centre.
10	7	0	4		·5321		
11	7	1	4		Broke.		¾ of an inch from the centre.

II. *Experiments of August* 23.

The bars upon which these experiments were made, were all cast from the same pot of metal, and at the same time; they were four in number; viz: No. 1, cast in green sand; No. 2, in dry sand; No. 3, cast in a *chill;* No. 4, cast in a *chill*, and afterwards annealed.

The total length of each bar was 18 inches, and the distance between the supports in each case 15 inches.



The figures above represent the sections of the bars, full size, as nearly as they could be taken.

With regard to the formation of Table No. 1, there will be no remark necessary, as it explains itself, excepting merely to observe that it appears from it, that green sand castings are 6 per cent better than dry sand, and 30½ per cent. better than chilled ones without annealing; and, lastly, that by the process of chilling and annealing, 115 per cent. is added to the strength of cast iron in respect of ability to resist impact.

Table No. 1.

Col. 1	Col. 2.	Col. 3	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10
Number of bar.	Weight of bar.	Area of section.	Weight, if reduced to same area as bar No. 1, ·46 in.; col. 3, col. 2, col. 4.	Densities of bars, taking bar No. 1 as standard, 32·5 is to col. 4 as 100, col. 5.	Weight actually borne by each bar.	Weight each would have borne, if reduced to area of No. 1, ·468 as col. 3, col. 6, col. 7.	Last column reduced to standard of 100, to show per centage.	Observed deflection or measure of elasticity.	Reduced to standard of 100.
	Ounces.	Inches	Ounces.	—	Lbs.	Lbs.	—	Inches.	—
1	32.50	·468	32·5	100·0	1232	1232	100·0	·130	100
2	30·50	·407	35·0	107·3	1008	1159	94·0	·114	87
3	34·75	·428	37·9	116·7	784	857	69·5	·053	40
4	34·50	·444	36·3	111·7	2520	2656	215·0	·148	114

Although from the smallness of the bars experimented upon, and their bad section for comparison with the experiments of others, yet the above are quite sufficient to show the vast superiority of cast iron treated in the manner described for No. 4, and the advantage resulting may safely be looked upon as very little less than 100 per cent.

It may also be well to observe, that these experiments show that the density of cast iron is by no means a criterion of its strength.

With regard to the table of experiments, the method adopted in order accurately to measure the deflection, was by having a cord from the bar under trial passed over and secured to a brass drum, exactly 4 inches in circumference; from the centre of the drum axle a large circle was described, the quadrant of which was divided into hundredths, and a pointer, fixed on the drum, consequently indicated with great nicety the most trifling deflection.

It may also be remarked that column 5 is the comparison of the deflection of bar No. 4 with Nos. 1 and 2 only: No. 3 not being a sample of common casting, and therefore not included in the average.

With regard to the microscopic appearance of the sections, No. 1 presents much the same appearance at the top as at the bottom of the section, excepting that in the lower part the fracture of the iron seems more open, but nothing like a crushed appearance is observed towards the top. The fracture in this bar is about ¼ of an inch from the centre, and goes through nearly in a straight line, and at right angles with the horizontal line.

No. 2.—With regard to this bar, exactly the same remarks apply to it as in the case of No. 1, excepting that the fracture took place in the centre between the ends of the bar.

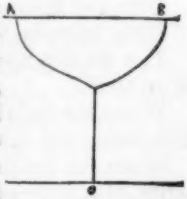
No. 3.—The fracture of this bar presents a very singular appearance;

it is highly crystallized, and the granular structure, instead of being homogeneous, as in the former cases, appears to be made of crystallized threads, radiating from the centre of the curves which form the profile of the section. An attempt to represent this appearance has been made in the engraving of this section (No. 3.) It broke with a straight fracture $\frac{7}{8}$ths of an inch from the centre of the bar, and about $\frac{1}{4}$ of an inch out of the perpendicular line in the width of the bar.

Table No. 2.

Col. 1	Col. 2.			Col. 3.				Col. 4.	Col. 5.	
Number of Experiments.	Load carried by bars.			Deflections observed in decimal parts of an inch.				Average deflection of Nos. 1 and 2.	Inferior deflection of No. 4, with same weight.	Remarks.
	cwt.	qr.	lbs	No. 1.	No. 2.	No. 3.	No. 4.			
1	1	0	0	·0000	·0000	·0000	·0000	·0000	·0000	
2	2	0	0	·0200	·0200	·0050	·0100	·0200	·0100	
3	3	0	0	·0350	·0350	·0175	0225	·0200	·0130	
4	4	0	0	·0500	·0525	·0236	·0365	·0350	·0150	
5	5	0	0	·0650	·0750	·0370	·0535	·0510	·0160	
6	6	0	0	·0775	·0875	·0420	·0650	·0700	·0170	
7	7	0	0	·0900	·0975	·0530	·0665	·0820	·0270	
8	8	0	0	·1025	·1084	Broke.	·0680	·0930	·0370	
9	9	0	0	1125	·1140		·0750	·1050	·0380	
10	10	0	0	·1213	Broke.		·6800	·1130	·0410	
11	11	0	0	·1300			·0870	·1210	·0430	
12	11	2	0	Broke.			·0900	·1300		
13	12	0	0				9500			
14	12	2	0				·1000			
15	13	0	0				·1050			
16	13	2	0				·1100			
17	14	0	0				·1150			
18	14	2	0				·1200			
19	15	0	0				·1285			
20	16	0	0				·1325			
21	17	0	0				·140 *			* Weight removed, and bar resumed its horizontal line.
22	18	0	0				·1200†			† Weight put on again, and deflections presented.
23	19	0	0				·1250			
24	20	0	0				·1300			
25	21	0	0				·1410			
26	22	0	0				·1475			
27	22	2	0				·1480			
28							Broke.			

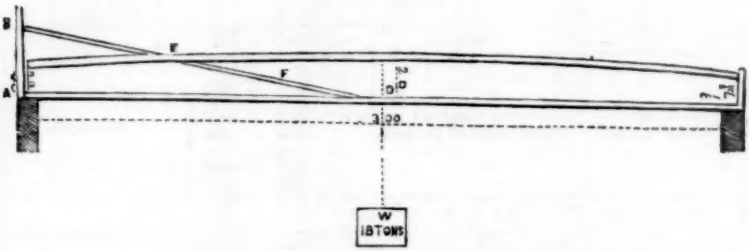
No. 4.—At the moment of fracture this bar broke in two places; the one a simple fracture about 5 inches from the end, and nearly at right angles to the plane of the bar, and the other a compound fracture, about $\frac{1}{4}$ of an inch from the centre, and represented in the adjoining figure, A B C representing the line of centre fracture. The iron had completely lost the crystallized appearance of No. 3, and had resumed the granular structure of Nos. 1 and 2, excepting that the grains are much finer and look more like the fracture of cast steel than cast iron.



Lond. Mec. Mag. Nov. 1847. ROBERT BOWMAN.

Extract from some Experiments upon Girders and Tensile Rods.

The annexed figure is an elevation of a large cast iron girder or beam, at the end of which is shown a piece of wood, AC, securely fixed. EF is a stout rod, (representing the position of the tensile bar,) one end turning on a centre, B, and the other end resting on a block, D, fastened to the bottom flange of the girder, at equal distance from the bearings.



The object of this experiment was to show, on applying the weight, W, how much the distance, BD, increased, or, in other words, to what extent a tension bar, fixed at the points, BD, would be stretched.

The variation in the distance, BD, was taken by a vernier, one scale of which was affixed to the block, D, the other to the rod, EF. The height of the point, B, above A, (or the bottom of the beam,) was varied in the experiment.

The weight, or load, was applied by means of hydraulic pressure, and the deflection with 18 tons was $\frac{6}{10}$ths of an inch.

When the height of the point, B, above A, was 1 foot 5½ inches, the distance, BD, increased ·038 in.

When the height of the point, B, above A, was 2 feet, the distance, BD, increased 0·217 in.

When the height of the point, B, above A, was 3 feet, the distance, BD, increased ·0064 in.

A similar experiment was made with a cast iron beam of different dimensions; the particulars and details are as follow:

Length of bearings, 24 feet 10 inches.

Depth of beam in middle, 1 foot 4½ inches.

Ditto at ends, 7¼ inches.

The weight applied to the middle was 12 tons, the deflection $\frac{7}{10}$ths of an inch.

When the height of the point, B, above A, was ½ inch, the distance, BD, increased ·0382 in.

When the height of the point, B, above A, was 10 inches, the distance, BD, increased ·013 in.

When the height of the point, B, above A, was 1 foot 8 inches, the distance, BD, *decreased* ·0145 in.

When the height of the point, B, above A, was 2 feet 6 inches, the distance, BD, *decreased* ·034 in. Ibid. Dec. 1847.

Chemical Action arrested by Mechanical Vibration.

A slip of iron, ¼ of an inch in diameter, was suspended perpendicularly by one end with a strong packthread, and, while so, a vessel of nitric acid was brought underneath it, and then raised so as to allow the lower end of the iron to dip into it. On this being done, energetic action took place, which was immediately suspended on giving the top end of the slip a smart blow in a perpendicular direction with a hammer. The iron was then let down in the acid, and remained perfectly inactive during two days. It also communicated inactivity to other pieces that were brought into contact with it. This experiment was subsequently varied, with, if possible, more interesting results.—A wire, like the one formerly used, was suspended in the same manner, but the packthread was now held in the hand; it was then struck at the lower end obliquely with a piece of iron, to cause it to ring, and while so, it was introduced into the acid. No action took place on immersion, but the instant the end of the iron came into contact with the side of the vessel, which had the effect of breaking the vibration, action proceeded most energetically, which, on being instantly removed to the centre, partially ceased; then went on, although less partially; but it was quite evident that, as the effects of the vibration became weaker, the action of the acid on the iron increased. Should it be immersed while under the effects of a slight ringing blow, the action is beautifully illustrative of molecular vibration, bubbles of gas being given off the surface of the iron in intermittent waves. Sometimes this is produced in a slip that has been often used, by a smart perpendicular blow at the bottom of the vessel containing the acid.—A structural alteration throughout the molecules of iron, has been long supposed to take place by some, and ridiculed as fanciful by others. This want of unity of opinion has sufficiently prevailed to prevent the fact from entering into practical consideration with regard to engineering matters.—*Mr. Spencer.— Liverpool Mercury.* Ibid.

The Wave Principle in Ship Building.

Mr. Scott Russell gave a lecture at the Royal Institution on the 2d instant, on the new principle introduced by him into ship building, called the Wave Principle. We extract the following abstract of it from the Athenæum. Mr. Russell's object was—first, to explain his theory of naval construction; secondly, to connect with that theory practical rules for the construction of ships; and, finally, to state the results which have followed the adoption of the form resulting from this principle,—by the general adoption of which the velocity of merchant steam ships have, within twelve or fifteen years, been raised from an average of nine or ten miles to an already achieved speed of seventeen or eighteen miles an hour. The theory is derived from the observed properties of what Mr. Scott Russell has termed *the solitary wave of translation*, (or the wave of the first order,) and those of the *gregarious wave of oscillation*, (the wave of the second order.) The

first named wave moves with a velocity which can neither be accelerated nor retarded by the velocity of the floating body which produces it; while the latter does depend on the speed of the boat by which it is caused. The solitary wave is formed by the bow of a ship when in motion, and its velocity depends on the curve of the water line of the vessel. Mr. Scott Russell proceeded to connect with these properties of the waves he described, the following principles of naval architecture:—1. The principle of removing the least quantity of water to the least distance. Assuming that all horizontal motion through a fluid implies the displacement of that fluid, it is obvious that the amount of moving power required to propel a vessel will vary with the bulk of water disturbed, and the range of its disturbance. In the ordinary construction, a great mass of water is set in motion on either side of the bows of the ship; but, as Mr. Scott Russell had proved experimentally in the wave boats, no more water was disturbed by them than was occupied by the immersed portion of the vessel. 2. The principle of adapting the form of the body which is to disturb the water to the natural form of the fluid which is to be disturbed. Referring to the properties of the wave of translation, Mr. Scott Russell proved that it was impossible to propel any vessel with a speed greater than that of the wave of the first order, which it produced by its motion; and that, therefore, wherever speed was required, the shape of of the vessel must be modified to accord with laws of that wave.—Thus, the length of fast ships must be great, (200 feet of keel being requisite to insure, with least power, a speed of 18 miles an hour, 300 feet of keel to attain 23 miles, &c.) On the same principle, boats made on the wave principle are broadest abaft the middle; the lines of run are much finer in the bow than at the stern, the bow portion of the water line being concave. 3. The principle of allowing the replacement of water to take place with the greatest possible velocity. The wave formed by the after part of a ship is not the wave of translation, but the oscillating wave of the second order. It arises from a vertical motion of the water from below to replace the hollow left behind the ship as it passes onwards. This replacement is most rapid when the stern portion of the water line is full. Mr. Scott Russell mentioned that vessels of various kinds, which had been built on the principles he described, (although the principles themselves were not understood by those who acted on them,) had always been remarkable for speed. The old Thames wherry, the smugglers' boats, privateers, the caique of the Bosphorus, fishing boats in the North of Scotland, have been built more or less on this principle; and it was remarkable that whenever the form of any of these vessels was changed, with a view to improvement, the speed was always diminished. But the most important test of the wave principle of construction, is afforded in the Holyhead fast boats,—all of which had systematically been constructed, with more or less accuracy, in conformity with the wave principle, and are propelled at the rate of from 17½ to 18½ miles an hour; the rapidity being the greatest in those boats in whose construction this principle is most accurately maintained. By the same principle, he felt satisfied that 23 miles an hour could be produced; and he was quite prepared to carry that speed practically into effect. **Ibid. July, 1848.**

Decomposition of Light by the Eye.

On closing the eyes, after having looked steadfastly at a sheet of white paper held in the sun for about half a minute, and covering them without pressure, to exclude extraneous light, (a silk handkerchief held in the hand will answer the purpose,) the figure of the paper remains visible for some time. At first it is generally white, and then gradually changes through the colors of the spectrum. All the colors are seldom seen at the same trial; and it rarely happens, when one or more are missed, that they afterwards appear. Thus, when the change is from green to red, yellow or orange are seldom seen. The change from white generally commences with a light indigo or blue, and terminates with red, or some compound of it,—but sometimes with a deep blue or violet. The colors are generally seen at the edges of the figure first,—though this is not always the case; and when they once appear, they often remain mixed up with those that succeed.—Many curious modifications and confused mixtures of colors will be perceived at times; but it seldom happens that the colors develope themselves, in the first instance, contrary to their order in the spectrum, although when the last has appeared they occur in various ways.—This is a phenomenon which I have not seen noticed anywhere; and it would seem to arise from the retina decomposing the light that falls upon it, surrendering the rays in the order of refrangibility.

London Athenæum, July, 1848.

F. C. Bakewell's Copying Telegraph.

We have this week seen a specimen of writing by the copying telegraph invented by Mr. F. C. Bakewell; wherein words traced from the original were legibly copied on paper, by an instrument that had no connexion with the one to which the transmitted message was applied, excepting by the usual wires from the voltaic battery. The letters traced on the paper appear of a pale color, on a dark ground formed by numerous lines drawn close together. The communications thus traced, we understand, may be transmitted at the rate of five hundred letters of the alphabet per minute of ordinary writing; and were shorthand symbols employed, the rapidity of transmission would be quadrupled. When this means of correspondence is in operation, instead of dropping a letter in the post-office box, and waiting days for an answer, we may apply directly to the copying telegraph, have it copied at the distant town in a minute or less, and receive a reply in our correspondent's handwriting, almost as soon as the ink is dry with which it was penned. There are various means, too, for preserving the secrecy of correspondence; the most curious of which is, that the writing may be rendered nearly invisible in all parts but the direction, until its delivery to the person for whom it is designed. The operations of the copying telegraph are not limited to the tracing of written characters. Letter press printing may be copied with even greater

rapidity than writing, and fac-simile copies of the morning papers may thus be transmitted to Liverpool and Manchester long before the papers themselves are delivered to their readers in London. The means by which these astonishing effects are produced, we are not at present permitted to state, as the invention is not yet protected; but we are assured that the method is simple, and that the mechanism is neither costly nor likely to get out of order. It is, indeed, one of the peculiar features of the copying telegraph that it cannot commit errors, because the communications it transmits are fac similes of the original writing. —*Spectator.* Ibid., May, 1848.

School of Chemistry.

We see with pleasure that a School of Chemistry has been established in Liverpool—under the superintendence of Dr. Muspratt, who was formerly Assistant Professor in the College of Chemistry in London. The spread of such institutions is a wholesome educational sign —and we hope ere long to see a school for analytical instruction founded in every great town in the kingdom. That in a country like ours this should not long since have been the case, is one of the abundant instances, now coming to the light of improved views in the matter of education, of the manner in which the national resources have been wasted. Chemistry must in future be part of all liberal—as it should be of nearly all operative—education. All the substances with which the workman deals and all the manufactures in which he is engaged contain important secrets to be yielded up to the practical chemist. The most valuable economic truths now to be discovered lie probably in that direction. It is well observed in the prospectus of this Liverpool Institution, that popular lectures on chemistry, however useful in their way, serve only to give a taste for science; they never teach it. "It can be taught only in schools where the student has to work with head and hands, under the eye of a professor." Why have not great towns like Manchester universities of their own—where practical rather than speculative knowledge may be taught—the lore of the Future may replace the lore of the Past, which has so long been held as the proper object of education—and the means may be elementarily inculcated of developing the great industrial resources of a country where population is pressing on them in a yearly increasing ratio? Ibid., July, 1848.

The Lackawanna and Wyoming Coal Region.

It is somewhat extraordinary that the Anthracite Coal Fields of the Lackawanna Valley, yielding this valuable mineral to an extent probably exceeded by that of no other mines within the bounds of the United States, have not attracted to a greater degree the capital and enterprise of the country. Situated at a distance from the city of New York which can be traveled in a single day, and in a region abound-

ing with the purest air, it presents at the present time uncommon advantages for the mining and transportation of this product. Although its vast resources yet remain but partially developed, a beginning has been made in this important branch of the mining interest. Besides extensive beds of coal, it also contains mines of iron, which have been in some degree improved. A railroad extending from Carbondale to Honesdale, through a distance of sixteen miles, and a canal running from that point to Roundout, upon the Hudson River, which have been constructed by the Delaware and Hudson Canal Company, a company which has for the last few years made an annual dividend of 20 per cent., afford a convenient avenue of transportation to the city of New York, through which it is annually transported to the amount of about three hundred thousand tons, from the mines to the Hudson. There are also other important works of internal improvement in this region which will constitute prominent channels of transportation in the enterprise that will soon be exerted in the development of its resources. A railroad has been finished by the same company for the distance of eight miles, from Carbondale to White Oak Run, penetrating some of the most interesting parts of the coal region, abounding in water power, iron ore, and valuable timber. There are other parts of this region which deserve consideration. The construction of a line of public works, which might constitute an avenue for the transportation of the rich mineral products of this part of the valley of the Susquehanna, and its adjacent territory, within the bounds of Pennsylvania, to convenient markets, was one of the earliest plans of improvement entertained by the enterprise of the Atlantic States. The Chenango and Chemung Canals are known to have been completed for the purpose of reaching the extensive beds of coal and mines of iron in that State, and the North Branch Canal was commenced, on its part, to meet the advances of New York, and to intersect one or both of those works. The canal to which we last alluded was prosecuted with great industry from the year 1836 to 1841. During the month of May of the latter year, a suspension of all the public works upon the unfinished lines of internal improvement was ordered by Pennsylvania, and at that time there had been expended upon what is denominated "the North Branch Extension," the sum of two millions four hundred and eighty-four thousand nine hundred and thirty-nine dollars and sixty cents. During the next session of the Legislature, a law was passed authorising the incorporation of a company for the purpose of finishing that portion of the line extending from the mouth of Lackawanna Creek to the northern boundary of the State, and thirteen miles of what was termed the "Wyoming Line," running from the Lackawanna down to the mouth of Solomon's Creek, which had cost the State five hundred and fifty thousand dollars, were added to "the North Branch Extension," all of which was proposed, under certain conditions, to be yielded up by the State.

In consequence of its inability to borrow the sum necessary to complete the work, upon which more than three millions of dollars had already been paid, the State now agreed to relinquish the work to the

enterprise of a company, for the period of forty years, upon condition that a little more than a million of dollars should be expended in its completion. On that part of the line reaching from the Lackawanna to the northern boundary of Pennsylvania, a distance of more than ninety-four miles, detached sections, amounting to a little more than thirty-two miles, have been completed, and more or less work has been done upon the remaining portion. There is another important consideration connected with this work, which is, that nearly all the lands to be occupied have been leased for the use and occupation of a canal, to be constructed by or under the authority of the State of Pennsylvania. The connexion of the North Branch Canal with the Chemung Canal of New York, at Elmira, will complete the line of inland navigation from tide-water to the great lakes.

The tonnage upon which the canal must depend for its revenue will be chiefly derived from the mineral products of the region stretching along its border. It will consist of anthracite and bituminous coal, iron, gypsum, salt, lime, and limestone. But although these products will doubtless constitute the greater portion of its freights, there will be a considerable amount realized from the transportation of sawed lumber, shingles, staves, and heading, merchandise, agricultural productions, as well as that which is derived from miscellaneous articles.

A prominent, and, we may add, a principal staple of exportation by the canal and its connecting works, would be derived from the rich coal beds of the Wyoming valley. The resources of the Wyoming coal region in that useful product are not generally known. It is believed, from a pretty full examination, that in the thickness of the beds, the quality of the coal, and the facilities for mining and shipping it upon the canal, this interesting valley abounds in that mineral, and possesses advantages for mining to an equal if not to a greater extent than any other part of the State of Pennsylvania. In evidence of this fact, it may be stated that a large amount of Wyoming coal is now exported more than two hundred miles to tide-water, and, in the markets of the Atlantic cities, enters into successful competition with coal carried from other regions but half that distance from the sea-board. By the terms of their charter, the North Branch Canal Company possess the exclusive right to the transportation of the valley of the Susquehanna, and in consequence no such rivalry as now exists in the exportation of this mineral throughout the valley of the Schuylkill can exist. If, by opening an avenue for the exportation of coal from this region northward, a market can be found for two hundred thousand tons of coal, there is in that amount a sure tonnage in this one article equal to the production of eight per cent. upon the capital which is necessary to complete the work. It is not doubted that by the North Branch Canal, Wyoming coal could be delivered upon Lake Ontario for less than five dollars a ton.

The increasing consumption of coal in the United States is a fact which should not be disregarded in considering the importance of this region. We are informed that throughout Western New York, and the populous region bordering the great lakes, anthracite coal is but

little used, excepting in carrying on a few branches of manufactures. Its use is applied to an increasing number of objects, and it is alleged that a vast amount would be consumed in the manufacture of salt, in iron foundries, and other species of manufactures, as well as for domestic purposes throughout the country bordering the great lakes west of Utica; without estimating the amount to be shipped at Oswego and Buffalo for the markets on the lakes and in Canada, and for the use of steamboats. The anthracite coal of Pennsylvania is now employed in steamboats which navigate the St. Lawrence, to which point it is brought by sea from New York, and is used with advantage one hundred miles north of the city of St. Louis. At Syracuse and other salt villages a very large amount is likewise consumed. There is at present no avenue by which the region bordering the lakes can be directly supplied; but when the North Branch Canal is completed, the country west of Utica can be provided with this product, and we are told that Pennsylvania anthracite can be delivered at Buffalo for about five dollars and fifty cents per ton, at Oswego upon Lake Ontario for five dollars, and in other places at proportionate prices. The coal field of Bradford county, lying upon the north-eastern verge of the bituminous coal region of Pennsylvania, and within twenty-five miles of the State of New York, occupies an area of about one hundred and fifty square miles, producing bituminous coal of the best quality; and it is somewhat extraordinary that this tract of territory, containing such abundant resources, should have been so greatly neglected by the active capital of the country. It is stated that not less than five hundred thousand tons of coal would annually find a ready sale in the country bordering the lakes. Subjoined is a statement, showing the distances from the mines below Lackawanna, to various points in the State of New York, where markets will be found for anthracite; as also the estimated nett value of a ton of coal delivered at these several points:—

From Coal Mines	to	State Line,	100	miles,	$2·55	value of coal per ton.
"	"	Elmira,	117	"	2·77	"
"	"	Seneca lake,	140	"	3·00	"
"	"	Geneva,	185	"	3·45	"
"	"	Montezuma	206	"	3·66	"
"	"	Palmyra,	241	"	4.00	"
"	"	Rochester,	270	"	4·30	"
"	"	Lockport,	334	"	4·94	"
"	"	Buffalo,	365	"	5·25	"
"	"	Syracuse,	240	"	*4·00	"
"	"	Oswego,	278	"	4·38	"
"	"	Rome,	286	"	4·46	"
"	"	Utica,	301	"	4·61	"
"	"	Little Falls,	323	"	4·83	"
"	"	Schenectady	381	"	5·41	"
"	"	Albany,	411	"	5·71	"

* Coal used in manufacturing salt would go free of toll from Elmira to Syracuse; and the cost for that object would be $3·75 per ton.

The coal trade is beginning to constitute a very important part of active enterprise in the United States. The south anthracite coal field, the middle and the Wyoming beds of Pennsylvania, it is well known, pour down upon the Atlantic cities a large amount; and with the decrease of the forests, and the new application of that product to various manufacturing purposes, the amount is annually augmenting. We subjoin a table of the amount of its consumption within the last twenty-seven years:—

A Tabular Statement, showing the Increased Consumption of Anthracite Coal, from its First Introduction to the year 1847.

Years.	Tons.	Years.	Tons.	Years.	Tons.
1820	365	1829	112,082	1838	739,290
1821	1,073	1830	174,734	1839	819,327
1822	2,240	1831	176,820	1840	865,414
1823	5,823	1832	363,871	1841	842,244
1824	9,541	1833	437,648	1842	1,108,000
1825	34,893	1834	376,636	1843	1,268,852
1826	48,047	1835	560,658	1844	1,627,588
1827	63,434	1836	682,428	1845	2,012,742
1828	77,516	1837	881,476	1846	2,338,560

Without entering into a particular consideration of the amount of iron, salt, plaster, and lumber, which would add to the transportation of the North Branch Canal, it is evident that the sale of Pennsylvania iron would be largely increased by its completion. The bar and pig iron of the Susquehanna valley could then be carried to Buffalo at a less price than it now costs at that place when brought a distance of three hundred miles from Lake Champlain. All the country in the State of New York lying between the Susquehanna and Lake Erie could also be supplied with this useful product; and as there is no duty charged upon American iron in the Canadas, it might be exported even to those markets. It is indeed computed, from a well-accredited source, that not less than four hundred thousand tons of Pennsylvania iron would find an annual outlet through the North Branch route; the boats carrying coal and iron into that region would bring back salt, plaster, and water lime; and the country lying near the banks of the Susquehanna would derive their supplies of those products from the State of New York through the Susquehanna and North Branch improvements. Another source of prosperity to the work would be the transportation of lumber from the northern counties of the State, sixty millions of feet of which now annually descend the Susquehanna.

An important feature of the works of the North Branch Canal Company, which will extend about one hundred and seven miles, is, that it will complete a continuous line of transportation extending from the coal fields of Wyoming, to Philadelphia, New York, Baltimore, and also the west. By their completion, the products of this region, now comparatively shut out from convenient markets, will find their way through various lines of communication not only to the shores of the lakes, but also to the principal cities upon the sea-board, and those cities will in return transport the products of their commer-

cial enterprises to the interior settlements of this region of Pennsylvania, which will be extended in proportion to the development of its extensive and valuable mineral resources. J. H. L.

Hunt's Merch. Mag., Sept., 1848.

Copper Sheathing.

A correspondent of the Mining Journal states, as the consequence of his experience, that, in the treatment of the sulphurets of copper, there should be one calcining, one roasting, one smelting, and one refining—four operations in all; and that care be taken that no iron tools be used, except the ladles for the refining process. The carbonates of copper require only two operations—smelting and refining; but if copper pyrites be mixed with the carbonate, it will require three operations instead of two. By attention to these operations all foreign matter will be disengaged. The production of good malleable and pure copper, depends on the refiner; the copper is brittle before, and should be stirred with a wooden rod. It requires considerable care to keep the metal to a proper heat until the moulding is finished, to give it due ductility, and make it suitable for the demands of commerce. In general, most operators go too far in the refinery, which renders the metal fibrous, and the result is serious lamination on one side of the sheet. If the copper ore is properly treated in the above operations, this metal is decidedly the best for ships' bottoms. The per centage of copper is also much increased by careful treatment, and the scoria comes out cleaner. Civ. Eng. & Arch. Journ., Aug., 1848.

Artificial Colors in Agate.

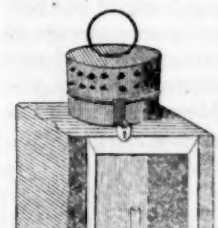
The change of color produced artificially in the agates, by the workers in them at Oberstein, an art learned from the Italians, and to which Mr. Hamilton calls attention in his communication, stating his belief, (referring also to the labors of M. Noeggerath,) that not a few of the onyxes which have come down from ancient times were thus treated, is of much interest mineralogically, since it shows the very different porosity of different layers in the agates, the least porous bands not being necessarily the nearest to the centre, but dispersed irregularly through the mass. To this porosity Mr. Hamilton calls attention, citing the researches of M. Noeggerath, who states, that in some layers the minute hollows can be seen by means of a magnifying glass; that, while some are round, others are long, and that they sometimes run into one another. These hollows, Mr. Hamilton considers, may form interstices between the radiating crystals. By immersion for some time in honey and water or olive oil, so that the pores of the agate become more or less filled with a substance to be carbonized, a subsequent soaking of the stone in sulphuric acid produces a difference in the agate according to the porosity of the layers, the most porous becoming black, while the least porous remain white or uncolored.—By immersion in a solution of sulphate of iron, and a subsequent

heating of the agate, a carnelian red is in like manner obtained for the most porous layers, the iron being converted into a peroxide, while the least porous layers continue unchanged in color. It would be out of place further to dwell upon the infiltration of mineral matter in solution into the isolated cavities of rocks. The mode in which the various minerals occur is highly interesting, as also their connexion with the matter filling veins and fissures in adjoining parts of the same or adjacent rocks, as, for example, the filling of the fissures in the red conglomerate, by the same kind of siliceous matter which entered into the cavities of the igneous rocks of Idal, the layers having, in both cases, adjusted themselves to the surfaces on which they were accumulated.—*Sir Henry T. De la Beche's Address, delivered at the Anniversary Meeting of the Geol. Soc. of Lond., Feb.* 1848.

Edin. New Phil. Journ., No. 89.

Safety Mining Lanthorn.

Mr. Crane, of Birmingham, has forwarded to the Mining Journal the following description of a mining lanthorn that he has invented. The annexed drawing is a representation of the safety lanthorn:—It



is adapted to burn composition candles that require no snuffing. The same principles can, however, be applied to oil lamps, if any party prefer oil to candles. The front is made of strong glass; the back of polished tin—the two sides of wire gauze, soldered to the framing, having 900 apertures in a square inch of surface. It will do coarser: but the size stated is safest. Over the wire gauze sides are fixed covers of tin, hinged to the top of the lanthorn, which entirely cover the sides, and are kept fast by a small hasp at the bottom. The lower edge of each tin coverside is bent inwards to rest against the framing—so that the tin plate may be kept at a distance of ¾ inch from the wire gauze. Sufficient space is thus provided to allow of the passage of air for the supply of the light. These tin coversides are useful to protect the wire gauze from injury and dirt, as well as to stop any current or "blower" of gas from blowing out the light. No direct current of wind can have any effect upon the light, because there is no admission into the lanthorn but obliquely at each corner. The candle is held between four short wires, soldered in the dish of a movable socket, which fits into a socket soldered to the bottom; this candle socket is useful for retaining any waste fat that may run down; it can be lifted out by the wire handle, and cleaned, when necessary. The inside of the lanthorn is thus kept quite clean. The candle is put in through the neck on the top of the lanthorn, upon which a hinged lid fits down tightly.—The lid is pierced with two rows of holes, through which the heated air and smoke escape; and to the top is fixed a large ring, by which the lanthorn is carried and hung up. This ring is kept cool by a sim-

ple, but effective contrivance. A piece of tin, bent into the form of an inverted cone, is soldered inside the lid, which causes the hot ascending air to flow towards the sides, where it immediately escapes through the openings. To prevent any inflammable gas entering through the lid, a circular disk of wire gauze is soldered inside the rim of the lid—so that no gas can enter but through the wire gauze; this wire gauze will never become red-hot, so that no explosion can possibly occur. The size of lanthorns made is about 5 inches square, and 12 inches high; other parts in proportion. The inside of the tin coversides, and the outside of the lanthorn, are japanned of any dark color.

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Description of Two Recent Inventions of Artificial Stone, with Remarks by Mr. Faraday.

Mr. Faraday said that, in undertaking at a short notice to describe the principles on which those artificial stones were constructed, he refrained from expressing an opinion as to their probable commercial success. He explained the process adopted and the object aimed at, first in Mr. Ransome's, and afterwards in Mr. Buckwell's invention. Broken flints are dissolved in a solution of caustic alkali at a temperature of 300° Fahr. When this solution is sufficiently evaporated, siliceous sand, or the flint grit of roads, and a little clay are worked with it, till the whole is of the consistence of putty. It is finally pressed in moulds, dried, fired for 48 hours, and then slowly cooled. The impression produced is very sharp; the stone resembles white sandstone, and is said to resist all atmospheric changes, and even acids. Philosophically considered, this artificial stone is a mass of sand cemented together by glass. The glass, at first containing excess of alkali, is diffused in a fluid state throughout the particles of flint and alumina. These particles absorb the superabundant alkali when the stone is fired, and the resulting vitreous cement resembles, in hardness and resisting power, the portion of glass which, in the common manufacture of the hardest kinds of that substance, is found in immediate contact with the sides of the pots. To show the unstable nature of ordinary glass, Mr. Faraday exhibited green bottles in which diluted sulphuric acid had been kept. In the glass of these bottles the lime had been separated from the silica by the sulphuric acid, and the insides were in consequence studded with multitudes of regularly-formed cones of sulphate of lime. Mr. Faraday then entered on Mr. Buckwell's manufacture. As the artificial stone invented by Mr. Ransome is chiefly applicable for ornamental purposes, so Mr. Buckwell's invention, termed by him *artificial granite*, appears exclusively designed to supply the place of blocks brought from the quarry for large works, whether walls of houses or of aqueducts, sewers, &c. Mr. Buckwell uses the following simple process:—Fragments of a suitable stone (Portland stone, for example) are gauged and sorted into sizes. These are cleaned and carefully mixed on a board with cement in the proportion of 5 parts of large fragments, 2 of smaller ones, 1 of cement, and a portion of water,—but the water is in *no*